GENERAL EQUILBRIUM ANALYSIS OF PRICE AND DISTRIBUTION CONTROLS FOR FOODGRAINS AND TEXTILES IN INDIA

P.V.SRINIVASAN

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Indian Statistical Institute

7,S.J.S. Sansanwal Marg

New Delhi - 110 016

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CHAPTER I

Introduction

Unlike in many developed countries, in India, institutions for distribution of goods and services are not well developed. Hence policy makers are concerned with the development of economic institutions to promote growth, remove unemployment and eradicate poverty. In addition to the general fiscal and monetary policy instruments such as taxes, subsidies, bank rate, open market operations etc, the government also uses several price and non-price controls. For example, it administers the prices of essential inputs such as steel, coal, power etc, and distributes certain essential commodities through ration shops at a price lower than the market prices.

One way of directly affecting the income distribution or consumption distribution is through food subsidies and distribution of food grains through the Public Distribution Scheme (PDS). This has its implications for the government budgetary system and the growth of the economy. Considering the magnitude of the poor it is almost impossible to devise a policy of income transfers from the rich to the poor in order to achieve the desired effects. Creating employment opportunities seems to be the only effective way of providing incomes to the poor. This point is reflected in the government's policy of protecting labour intensive techniques of production though they are technically inefficient. The Seventh Five year Plan (1985-1990) gives the maximum importance for the creation of employment opportunities. Encouraging production of cloth through the handlooms is an example of this point of view. Thus, the trade off between growth and equity should be taken into account and the methods used to achieve income redistribution should maximize growth while achieving a predetermined income distribution.

In this study, the focus is on evaluating the effects of government's policies in the foodgrain and textile sectors. Government intervention in the foodgrain sector is mainly in the form of price and quantity regulations whereas in the textile sector it is mainly in the form of taxes, though there are some quantity restrictions on the production of mill cloth, such as restrictions on the expansion of loomage in the mill sector. During the past decade there has not been any appreciable change in the Gini coefficients for the distribution of food and clothing expenditures in India. Since food and clothing are basic necessities of human life, planners in developing countries are interested in ensuring that the distribution of these basic necessities is not very skewed and that every one in the economy can afford to have atleast the minimum requirements.

Most of the earlier commodity specific studies for India have made use of partial equilibrium analysis with some exceptions like Kirit Parikh and N.S.S. Narayana (1981). Several studies on food policies exist [Chopra (1981), Satish Chandra (1985), Kahlon and Tyagi (1983) etc.] where one can find a detailed discussion of the general progress of food policy in India through the years with emphasis on price policies, procurement, stocks and distribution arrangements. Specific food grain models have been developed [Raj Krishna and Ajay Chhibber (1983), Raj Krishna and Ray Choudhuri (1980)] for analysing wheat and rice policies in India. Similarly, for the textile sector we have studies [Omkar Goswami (1985), B.V. Iyer et. al. (1982), Sukumary Murthy (1983), D.U. Sastry (1984) etc.] which concentrate on the consumption patterns of different types of cloth accross different socio-economic groups and estimating price and income elasticities. Most of these studies have used either the NSS consumer expenditure survey data or the data collected by Market research wing of the Textile Committee. There are studies on the supply aspects [like Dipak Majumdar (1981)] giving estimates of the cost of production in the different producing sectors and also studies (D.U.Sastry (1984)) analysing factors influencing capacity utilization and productivity.

A general equilibrium model provides a framework through which the efficiency losses and the distributional effects due to policy interventions can be estimated while taking into account the demand-supply interactions. In the present work we make use of a computable general equilibrium model with 11 sectors in order to study the effects of policy changes through several simulation exercises. The model is built in such a way as to incorporate economic institutions and policy instruments such as taxes, subsidies, price controls, quotas and credit controls. Most of the behavioural relations have been statistically estimated using the time series data for the period 1960-61 to 1980-81. Alongwith the estimated relations macro economic identities are used. In particular, the households, the firms and the government are constrained to balance their budgets. Financial requirements of government's expenditures are always met; if necessary, through deficit-financing. Ofcourse, deficit-financing will have its implications for the sectoral outputs and prices. All markets clear through the price mechanism with some exceptions, where prices are administered or rigid due to other reasons.

The Plan of the study is as follows.

In Chapter II the structure of the model, which is used for analysing the policy effects, is described and its special features are discussed. The different methods used in obtaining the behavioral relations, the income generation mechanism, the rationing mechanisms used, etc, are also described. Finally, the reliability of the model is checked by computing equilibrium values for a given set of exogenous variables and comparing these equilibrium values with the corresponding observed values.

In Chapter III certain policy issues related to the Foodgrain sector are discussed and the effects of some of these policies are studied through simulation experiments. The policy exercises include evaluating the effects of a) procurement policy on producers' incentives b) welfare effects of the public Distribution Scheme c) the alternative ways of dealing with the increasing foodstocks with the government, etc.

In the end the estimated demand and supply elasticities for the three major cereals, Rice, Wheat and Jowar are presented. These are compared with those available in the literature.

Certain implications of these estimates for the policy analysis are also indicated.

In Chapter IV, simulation exercises are conducted to evaluate certain policies related to the textile industry. Main focus is on the effects on the total output of cloth and on the employment generated in the textile industry.

Finally, the estimated parameters are presented and their policy implications are discussed.

A brief summary the results is given in Chapter V.

CHAPTER II

Description of The Model

II.1 : Introduction

The current literature on computable general equilibrium (CGE) models owes a lot to Herbert Scarf who had developed, in 1967, a computer algorithm for numerical determination of equilibrium prices of the Walrasian system. This development has enabled many researchers to carry out numerical investigations of various policy issues. The earlier CGE models were applied to developed countries and focussed basically on tax and trade policy issues. A survey of these models can be found in Shoven and Whalley (1984). Applications of CGE models to developing countries started with the works of Adelman and Robinson (1978) and Lysy and Taylor (1980)*. The use of multisectoral macro economic models helps the policy maker by providing substantial details about the interactions between the sectors and also the feedback effects of policy initiatives directed only at specified products or sectors. In India, the plan models are basically input-output based multisector models.

In plan models the relative prices of the goods are held constant. Behavioural relations such as demand and supply functions are assumed to depend only upon relative prices. Thus financial intermediation plays no role in resource mobilisation

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* See Devarajan and Robinson (1983) for an extensive bibliography of published work on CGE models applied to developing countries.

or commodity distribution. Assuming a rate of growth for the gross domestic product (GDP), the sectoral growth rate of private final consumption goods are worked out using empirically determined income elasticities of demand. This along with the exogenous public consumption demand, determines the vector of final demands. Using an input-output matrix, a technically feasible production plan consistent with the assumed growth rate is then worked out. The private and public sector investment is determined from the GDP growth rate using a capital-output ratio. At the assumed prices, the financial requirement of the public sector is determined. At given rates of taxes, the amount of financial resources are significantly less than the required amount. Schemes for additional resource mobilisation are then worked out. A crucial assumption here is that the method of raising additional resources will not affect the assumed relative prices. In other words, economic policies designed to raise resources, whether monetary or fiscal, do not affect the growth or private investment allocations.

Consumers and investers are perhaps influenced only by real quantities like relative prices. Then the dichotomy of the real and financial sectors will hold good. Monetary policies will be ineffective. Even if these assumptions are plausible, it will be useful to deduce these propositions from empirical analysis using models which allow for the possibility of interdependence of real and financial sectors. *Behavioural relations in plan* models typically refer to consumers' demand for goods and services. It will be useful to introduce behavioural relations relating to private investment, both in financial and physical assets.

It is well known that relative prices play an important role in equating the demands and supplies of different commodities and hence determine the levels of output in the different sectors. It is necessary to take into account the changes in relative prices while evaluating the impact of various taxes, controls and other policy interventions and also while making decisions about fixing the administered prices, licencing regulations etc. Hence it will be useful to incorporate the features of the CGE models into our plan models.

Income distribution accross different socio economic groups is one of the major indicators of economic development. Changes in sectoral prices, production and employment have significant impact on the income distribution. So long as the market mechanism determines the levels of outputs and prices (but for some government interventions) there is a need for multisector models with a general equilibrium framework. Institutional features are easily incorporated in a CGE model. Policy instruments like taxes and price controls can be handled and rationing can be introduced whenever there are price rigidities.

II.2: Structure of the model

For the model to be consistent it is very essential that the different types of agents in the economy (consumers, producers and government) satisfy their budget constraints. Suppose there are only two types of agents : Private and Public. Equality of income and expenditure for the two categories is verified by the national income identity. If the budget constraint for the public sector is also verified then the budget constraint for the private sector is automatically satisfied. Thus it is relatively easy to verify the budget constraints in this case.

Aggregation of consumers and producers into one category may not be serious in the case of a barter economy where only real quantities are dealt with. For most commodities and services, it is easy to classify the demand (or supply) as a consumers' demand (or supply) or Producers' demand (or supply). For example, the aggregate demand for wheat can be assumed to be essentially the consumers' demand, since the producers' demand (for seed) is small. Similarly, the aggregate supply of wheat is really the supply of producers. Thus there is a reasonably well defined distribution of goods between consumers and producers.

This problem becomes more complicated when financial intermediation is involved in production and distribution. Consider, for instance, the distribution of money (narrowly defined as currency plus demand deposits) and bank credit. If most of the money is being is held by the consumers outside the banking system, the level of bank credit that could be generated will be small. Hence, the supply of credit to the commercial sector will be low, possibly affecting the level of production. Thus the distribution of money between consumers, banks and producers can affect the level of economic activity, especially in a country where commodities are distributed through a market mechanism. Also there is no natural way to distribute money among various categories. Hence, if the effects of monetary and fiscal measures are to be studied analytically, the level of disaggregation should be such that there are atleast the following categories:

1. consumers
2. producers
3. government

Budget constraints for each of these categories are incorporated in the model.

Walras' law

The government balances its budget (if necessary, through borrowing from the Reserve Bank). The endogenous sources of government revenue are :

1. Direct taxes
2. Indirect taxes
3. Surplus of public enterprises
4. Borrowing from the Reserve Bank

Other sources of revenue are assumed to be exogenous. The endogenous component of the expenditure relates to fixed capital formation. The public sector investment for the year 1980-81 is fixed at the observed figure of Rs. 4092 in 1970-71 prices. Other government expenditures are fixed in nominal terms. The amount of deficit financing (Reserve Bank credit to the government) is chosen such that expenditure is equal to revenue at given rates of taxes and other revenues.

Let x_g^d, x_p^d denote the demand vectors of the government and the private consumers respectively. Then the government's budget constraint can be written in a simplified form as follows.

$$p.x_g^d = t.x_p^d + \Delta m^s \qquad (1)$$

where,

p is the producer price vector,

t is the vector of tax rates and

Δm^s is the budget deficit of the government

For the consumers, the budget identity is built into the model in the following manner. At any given price, the income accruing to the consumers is obtained from the value added (wages plus profits) generated from the production vector or the supply vector. The expenditure on goods and services is calculated using the demand functions. Financial savings is obtained as residual. A fraction of this saving is assumed to be held in the form of time deposits, which affects the supply of credit. Thus at all prices the consumers' budget is balanced. In a simplified form the budget constraint can be written as

$$q.x_p^d + \Delta m^d + \Delta B^d = wL^s + \pi \qquad (2)$$

where,

q is the consumer price vector ($q = p + t$)

w is the wage rate

L^s is the labour supply

Δm^d is savings in money

ΔB^d is savings in financial assets other than money (say bonds) and

π is the profit plus interest income.

Producers' expenditure includes both expenditure on current production as well as investment expenditure. This expenditure will be accruing to the consumers in the form wages and profits. Producers' budget is satisfied if the credit demand is obtained as a residual (the difference between expenditure and income). Since, precise determination of producers' income is difficult, the demand for credit is statistically estimated instead of being obtained as a residual. In this case, the budget constraint may not be satisfied at all prices. But, using an estimated credit demand function yields better results.

The simplified version of the budget constraint is as follows:

$$wL^d + \pi = p.x^s + \Delta B^s \qquad (3)$$

where,

L^d is the labour demand,

x^s is the total supply vector and

ΔB^s the demand for credit

Adding up the equations (1) to (3), Walras' law is obtained.

$$p.(x_p^d + x_g^d - x^s) + w(L^d - L^s) + (\Delta m^d - \Delta m^s) + (\Delta B^d - \Delta B^s) = 0 \qquad (4)$$

Assuming ΔB^d and ΔB^s to correspond to credit supply and credit demand respectively, if the commmodity markets and the credit market are in equilibrium, then the money market clears

($\Delta m^d = \Delta m^s$) by *Walras'* law.

II.3: **Equilibrium Mechanisms and Income Distribution**

In each sector, equality between demand and supply is achieved either by the price mechanism or the rationing mechanism. In the case of foodgrains and industrial raw materials the prices are assumed to be flexible. When a public distribution scheme is introduced, a fixed quantity is sold at the ration price and the rest is distributed in the open market. The open market price is determined by the market mechanism. In most of the simulation exercises, downward rigidity of prices has been assumed for the following sectors : consumer durables, construction, plant and equipment, basic and intermediate goods and services. In any sector, if there is excess supply at the lowest permissible price level, this quantity is taken to be an addition to the inventory.

The interest rate on bank credit is rigidly fixed. When the excess demand for credit is non-positive, it is defined to be an equilibrium. If there is excess demand for credit, then the bank credit to the commercial sector is reduced. Since both supply and demand for credit are endogenous, an equilibrium level of rationing is chosen along with other equilibrium prices and inventory changes.

In the present model, the demand for credit arises only from two sectors : business (private) and government. The consumers are net suppliers of financial savings and hence credit. This is quite reasonable since bank credit to consumers is negligible. In the Indian economy, the role of credit is essentially to facilitate the activities of producers and the government.

A flow chart for the equilibrium mechanism is on page 15.

Income Distribution

Consumers are assumed to belong to either of the two broad "sectors" : rural and urban. Each of these sectors is divided into the following five different income groups.

Table II.1 : Income Groups

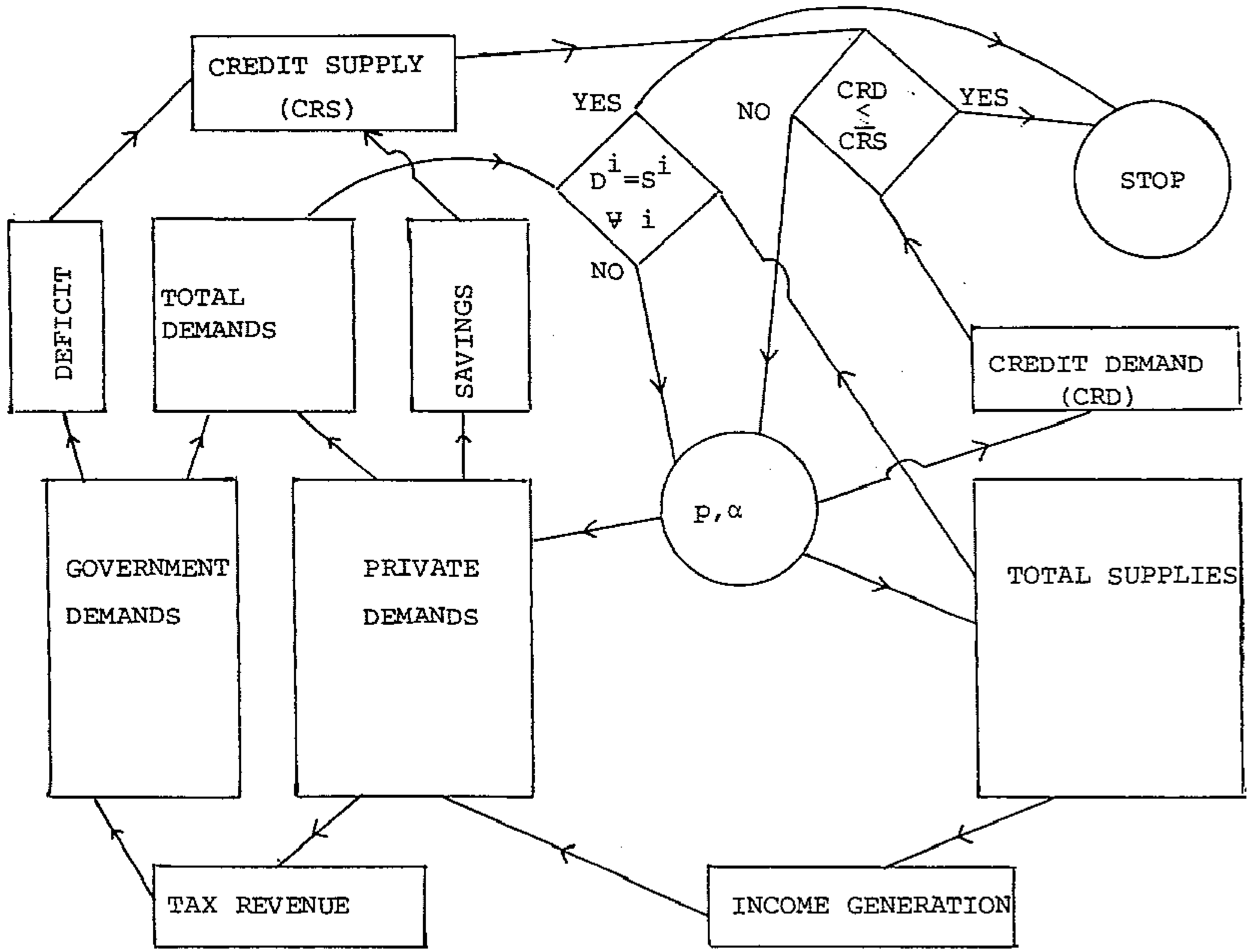
Income group	Monthly percapita expenditure range in Rs. (1973-74 prices)
1	0 - 34
2	34 - 43
3	43 - 55
4	55 - 75
5	75 and above

The distribution of the sectoral population among the income groups is assumed to be the following.

Table II.2 : Distribution of Population

Income group	Rural	Urban
1	.2540	.1241
2	.1957	.1501
3	.2058	.1939
4	.1897	.2273
5	.1548	.3043
All	1.0	1.0

Source : Dreze (1983).



p : price vector

α : rationing mechanism for credit

<u>Flow chart : Equilibrium Mechanism</u>

Figure - 1

This distribution is assumed to remain unchanged for the different policy simulation exercises.

Income distribution accross these income classes is obtained endogenously by distributing the value added from each of the production sectors accross income classes. This is done using the procedure developed by Sinha et. al. (1979), modified and extended by Dreze (1983). The matrix of value added coefficients and other details concerning the calculation of value added are given in Appendix III.

Sectoral Classification

The economy is divided into the following 11 sectors.

1. Foodgrains (FG)
2. Industrial Raw materials (IR)
3. Consumer Non Durables other than textiles (CND NT)
4. Consumer Durables (CD)
5. Construction (C)
6. Plant and Equipment (PE)
7. Basic and Intermediate goods (BIG)
8. Services (SE)
9. Textiles - Cotton (TC)
10. Textiles - Synthetic (TS)
11. Bank Credit (CR)

There are estimated demand and supply equations for each of the sectors. The demand functions depend, in general, on own price, money income and prices of substitutes. The supply function of a sector depends upon own price and the prices of inputs relevant for that sector and other relevant variables.

Production in any sector will certainly be influenced by the availability of credit. When credit market is perfect and interest rates are fully flexible, supply will be affected by the cost of credit, the rate of interest. However, when the rate of interest on advances and the distribution of credit are regulated, as is the case in India, the level of production will be influenced either by the cost or volume of credit depending upon the excess supply or demand for credit. In other words, when credit is rationed due to excess demand at a fixed interest rate production will depend upon the volume of credit. Hence, in the estimation of supply functions, both interest rate and volume of credit were included in the set of explanatory variables.

Supply of bank credit is assumed to depend on high-powered money and the financial savings of the households in the form of time deposits. Other variables like the reserve ratio did not yield statistically significant results. The demand for credit is estimated as a function of the price level (a weighted average of prices with weights proprtional to value added by sectors) and the interest rate on advances.

All functions were estimated using time series data for the period 1960-61 to 1980-81 using Ordinary Least Squares. Different functional forms including loglinear and linear equations were tried. The equations with reasonable signs and magnitudes for income and price elasticities and an admissible Durbin-Watson statistic were selected. The details regarding the estimated equations and data sources are given in the appendices.

II.4 : Model Validation

Before making use of the estimated model for policy analyses it will be useful to check the reliability of the estimated model. For this purpose the equilibrium prices and the values of other endogenous variables corresponding to the exogenous variables for the year 1980-81 have been computed. These computed prices are then compared with the observed prices (see Table II.3 below).

It is interesting to note that the computed over all price index is quite close to the actual figure observed for the year 1980-81, though the computed sectoral prices are not as good. The equilibrium GNP is also reasonably close to the observed figure. Equilibrium prices of primary products are much lower than observed prices. This is partly due to ignoring some government policies to support prices in this sector. Prices of consumer goods are also less than the observed prices. Computed prices of investment goods and services, particularly, construction, are much larger than actual prices. This is partly due to the administered prices in the construction industry (like Cement, Steel).

Table II.3: Equilibrium values for 1980-81

Sector	Output (units)	Price Index (1970-71=100) Computed	Actual
FG	120.3 (Million tonnes)	185.54	208.0
IR	121.6 (prodn. index)	146.54	217.0
CNDNT	13934.5 (Rs.Crs at 70-71 prices)	110.87	218.0
CD	2845.0 (--do--)	163.61	213.0
C	68.9 (Rs.Crs / Price index)	364.00	237.0
PE	57.3 (--do--)	193.49	226.0
BIG	152.1 (Prodn. index)	262.63	302.0
SE	108.8 (Rs.Crs / Price index)	302.00	214.0
TC	8291.9 (Million metres)	185.87	213.0
TS	3308.2 (--do--)	209.12	210.6
Over all Price level :		235.67	232.3
GNP (Rs. Crs at market prices)		129706.50	128224.0
Gini Coefficient :			
		Rural	0.298814
		Urban	0.280237

Criteria for policy evaluation

In order to arrive at policy conclusions by comparing equilibria for different policy regimes, certain welfare criteria can be made use of. This involves the choice of a suitable welfare function or the problem of assigning suitable weights to different income classes. Since distribution mechanisms for income and commodities are built into the model, the losses/gains accruing to different income groups can be obtained seperately. For the alternative equilibria, the effects on the distribution of income and commodities are examined using Gini ratios. Impacts of policy changes on the macro economic aggregates such as the growth rate and inflation rate can also be examined. In short, the focus is on the impacts on growth and equity. After all, the distribution of growth over different types of economic activities and of income over different socio-economic groups are some of the key indicators of economic development.

CHAPTER III

Effects of Selected Foodgrain Policies

III.1: Introduction

In this chapter the implications of the following policy interventions of the government are studied :

1. Compulsary procurement of foodgrains from the farmers at a price lower than the market price,

2. Distribuion of foodgrains at a concessional price to the consumers through the public distribution scheme (PDS) and

3. Policies relating to the disposal of excessive food stocks.

Government policies towards agriculture since independence have focussed on 1) increasing domestic production through input subsidies, providing irrigation facilities, etc. and 2) providing food subsidies to consumers through PDS, famine-relief, food-for work programmes etc. The history of price controls and other food policies in India is well documented in R.N.Chopra (1981). The present system of public distribution of foodgrains had started during the period of second world war. The PDS is maintained through mainly three sources of foodgrain supplies - domestic procurement, imports and depletion of inventories. The Central and State governments along with various supporting organisations carry out the functions of procurement, movement, storage and distribution of foodgrains. The procurement and sale prices of foodgrains from the central pool are determined by the department of food based on the recommendations of the Commission for Agricultural Costs and Prices.

In order to protect the poor who suffer the most due to price fluctuations and provide them with atleast the subsistence level of consumption, the governnment distributes a part of the total supply through the PDS at a concessional price.

It will be of interest to policy makers to know as to what impact the procurement policy has on the farmers' supply response, what effects the PDS has on the distribution of foodgrains etc. The present model has been designed to answer such questions. Through different simulation exercises, the effects of various policies are examined. Policy implications can be derived by computing the market clearing prices and their movement under alternative assumptions regarding the nature of the market.

The plan of this chapter is as follows. In section III.2, the effects of the procurement policy of the government on the aggregate supply of foodgrains is studied. In section III.3, the welfare effects of the public distribution scheme and the distributional implications are worked out. In section III.4, the focus is on the evaluation of the alternative options open to the government regarding the disposal of surplus foodstocks. In section III.5, the estimated parameters relevant for the policy exercises are presented and discussed.

III.2: Effects of Procurement Policy on the Supply of Foodgrains

Do the farmers lose due to the procurement policy of the government? In other words, does the procurement policy depress the prices received by the farmers? This is an empirical question and the estimated model is used to answer this.

A price lower than the market price is imposed on the farmers for government's purchases of foodgrains. Therefore, it appears that the farmers might be financing the food subsidy involved in the public distribution scheme. But this may not necessarily decrease the farmers' profits, since the price in the open market may increase to such an extent that the weighted average price may be greater than the price prevailing prior to government intervention.

This can be explained with the help of a diagram, as in Chetty and Jha (1983). In figure 2, the curves labelled S and D denote respectively the aggregate supply and the aggregate demand functions under free market conditions, that is, with no government intervention. The equilibrium price is q^o and the corresponding output is Q^o. Now, if the farmers are required to supply a fraction θ of their output at the procurement price $\bar{p}$, what will be the new supply curve? If the open market price is q^1 then the farmer effectively receives a price $q^1_\theta = \theta\bar{p} + (1-\theta)q^1$. Thus at the open market price q^1, the supply of output is obtained by finding weighted average price q^1_θ and then determining the corresponding output from the S curve. It can be noted that when the open market price is $\bar{p}$ the weighted average price is equal to

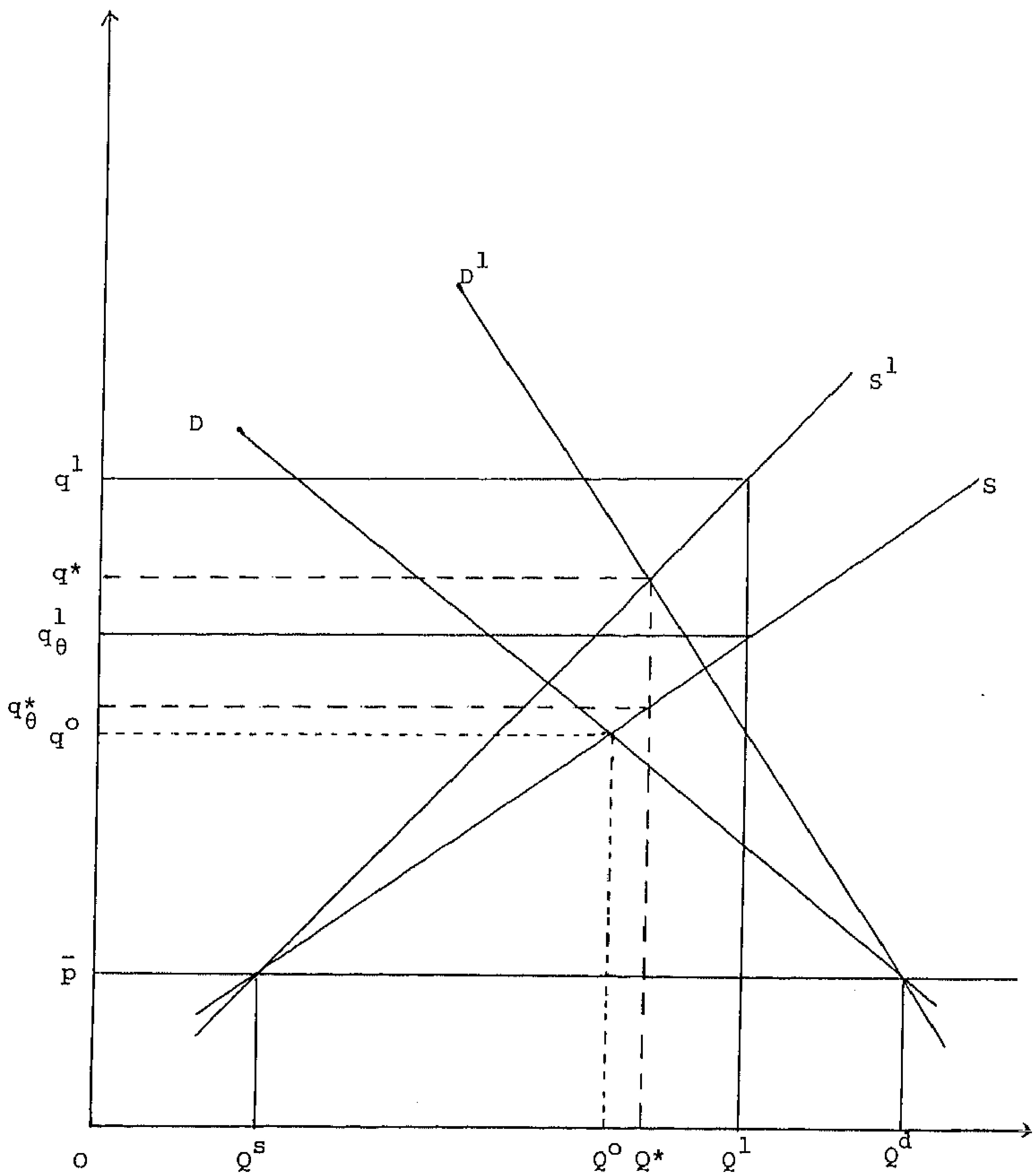


Figure - 2

$\bar{p}$. Thus, the supply curve under the dual pricing policy and the supply curve under free market conditions will intersect at $(\bar{p},Q^s)$. If the open market price is above '$\bar{p}$', the supply under dual pricing will be strictly less than the supply under free market conditions. Thus the supply curve under dual pricing (S') is obtained by suitably rotating the curve S around the point $(\bar{p},Q^s)$.

The aggregate demand curve under dual pricing can be obtained similarly. Let the open market price be q'. With dual pricing, consumers get an income subsidy of $D(q'-\bar{p})$ where D is the total ration quota. Assuming foodgrains to be normal goods, this will lead to an increase in the aggregate demand. Also, if the open market price is also ' $\bar{p}$ ', then this effect is zero. This means that demand curves under dual pricing and free market conditions will intersect at $(\bar{p},Q^d)$. For open market prices greater than $\bar{p}$, the demand curve under dual pricing D' will be to the right of D, the demand curve under free market conditions . These curves are shown in the figure.

With the help of the curves D' and S' we obtain, under dual pricing, the equilibrium output Q^* and the weighted average price q^*_θ respectively. Depending on the elasticities of the demand and supply curves we could either have $q^*_\theta < q^o$, $q^*_\theta = q^o$ or $q^*_\theta > q^o$. Correspondingly $Q^* < Q^o$, $Q^* = Q^o$, or $Q^* > Q^o$. $q^*_\theta = q^o$, $Q^* = Q^o$ implies that the revenue received by the producers under dual pricing is the same as that received under free market conditions. This means that, with dual pricing, the loss in revenue due to the sales at the control price is exactly matched by the gain in the revenue due to sales in the open market. In other words, the buyers of foodgrain in the open market exactly subsidize the buyers in the ration shops. That is, it is simply a redistribution of income from the relatively rich to the poor. In the case where $q^*_\theta > q^o$, the producers will also be benefited.

Thus, equilibrium prices will have to be computed for both the cases 1) with procurement and 2) without procurement. The equilibrium weighted average price in case 1 can be compared to the equilibrium price in case 2. If the former price is higher than the latter then there will not be any adverse effects on output due to the procurement policies.

For the purposes of this exercise the following features have been incorporated into the model. The foodgrains sector consists of estimated demand and supply equations for each of the following cereals: rice, wheat and jowar. The government is assumed to procure a fixed quantity (15 million tonnes) of foodgrains from the farmers. All the exogenous values used for the simulations correspond to the year 1980-81. The procurement price is fixed at 120 (price index, 1970-71=100) which is about 70% of the open market price. This means that farmers are forced to sell a portion of their total output at the procurement price, (say $\bar{P}$) while the rest of the output can be sold at the market price q. $\bar{p}$ is less than q. Equivalently, it can be assumed that the farmers receive a weighted average price $(\theta\bar{p} + (1-\theta)\, q)$ for the sale of their entire output. Here θ is the ratio of the procurement quantity to the total supply. In other words, the aggregate supply function depends on the weighted average price among other variables (the exact specification of the estimated supply function is given in section III.5).

For the present simulation exercises it is assumed that the entire quantity of procured foodgrains is distributed through ration shops at a concessional price. For simplicity, ration price is assumed to be equal to the procurement price. This implies that there is no effect on the government budget due to its procurement and rationing policies. In the case of wheat until 1966 domestic procurement provided less than 2% of the foodgrain issues to the ration shop and imports provided the rest. Later on output growth due to the introduction of high yielding variety technology enabled procurement to roughly equal issues. In the case of rice, domestic procurement has always been roughly equal to the issues. In the estimated aggregate demand equations for both rice and wheat, the ration quantity enters as one of the explanatory variables. The situation where there is no government intervention is obtained in the model by making the ration quantity entering the demand functions zero, and by taking θ to be zero, which enters the expression for the weighted average price.

Six different weather conditions - using hypothetical values for the rainfall indices - have been assumed, and for each of these scenarios equilibrium prices have been computed for the two situations : 1. with dual pricing and 2. without dual pricing.

The results reveal that (see Table III.1) the weighted average price under the procurement policy is greater than the open market price in the absence of procurement policy. This is true for both rice and wheat and for all the weather conditions assumed.

This leads to the conclusion that farmers really do not have disincentives for producing more under the dual pricing policy adopted by the government. In other words, whenever there is procurement by the government open market prices go up steeply and enable the farmer to receive a weighted average price for his total sales which is no less than what he would have received in the absence of procurement.

Similar results were obtained in the earlier literature. For example, in a study by Subbarao (1977) it has been shown that farmers were compensated for the lower price through a "sufficient" rise in the open market price. This study was based on primary data collected from Andhra Pradesh, for the years 1973-74, 1974-75 and 1975-76.

From the above results, one can also infer the following. In so far as the small farmers are excluded from levy obligations they can benefit more than the big farmers from a higher (higher than the weighted average price which the big farmers receive) open market price. But their benefit is limited to the extent of their marketed surplus.

Table III.1 : Effects on prices due to procurement policy

		Prices under different weather conditions					
		(1)	(2)	(3)	(4)	(5)	(6)
rice	with proc.	178.0	150.7	171.8	166.03	160.6	155.5
	without proc.	170.4	142.5	164.1	158.2	152.6	147.4
wheat	with proc.	190.8	175.6	186.9	183.3	179.9	178.0
	without proc.	175.1	159.4	171.1	167.4	163.9	161.9

Contd...

Explanatory notes

1. The six different weather conditions correspond to the different rainfall index values given in the table below.

2. The results were obtained using the demand functions in the form of share equations (see Section III.5.1).

3. Prices quoted in the "with procurement" case refer to the weighted average price received by the producers and those quoted in the "without procurement" case refer to the open market price.

Table III.2 : Rainfall Scenarios

Scenario	Rainfall index		
	Rice	Wheat	Jowar
1	70	50	100
2	120	160	150
3	80	75	110
4	90	100	120
5	100	125	130
6	110	140	140

III.3: Welfare effects of the Public Distribution Scheme

Using the computed equilibrium prices the welfare effects of the dual pricing policy on the various income classes in both the rural and urban areas can be obtained.

Providing a ration quota (D) at a price ($\bar{p}$) lower than the equilibrium open market price (q') means an income subsidy of $D(q'-\bar{p})$ for a consumer who buys atleast as much as the ration quota. But then, an increase in the open market price due to the PDS will mean some loss to the consumer assuming that his total demand remains unchanged after the introduction of the dual pricing policy. This loss can be given by the expression $(q'-q)x$ where x is the total demand and q the open market price in the absence of the dual pricing policy. The net effect may be a loss or gain depending upon the amount he consumes. The net monetary benefit can be calculated using the following expression:

$$D(q'-\bar{p}) - (q'-q)x$$

This expression can be derived as follows. Let an individual's utility function at price q and income m be given by the indirect utility function V(q,m). If the open market price under rationing is q' the utility of the individual is given by $V(q', m+D(q'-\bar{p}))$ if the total consumption is atleast D. The change in utility dV is given as

$$dV = \frac{\partial V}{\partial q} dq + \frac{\partial V}{\partial m} dm$$

$$= \lambda \{-(q'-q)x + D(q'-\bar{p})\} \text{ approximately}$$

where λ is the marginal utility of money and x the total demand. Assuming λ to be equal to unity we get the expression

$$dV = D(q'-\bar{p}) - (q'-q)x$$

Based on the NSS (28th round) consumption data relating to the year 1973-74, the net benefits accruing to the different expenditure groups have been calculated using the above expression (see Table III.3).

It can be seen that the relatively poorer people are gaining while the relatively richer people lose. This is a clear case of a transfer of income from the rich to the poor.

The main purpose of the PDS is to supply a minimum portion of the total grains supply at a concessional price to the vulnerable low-income population who would starve due to any significant increase in the price of food grains brought about by drought and/or inflation. However, one can notice that mostly the urban population is being benefited by this scheme. The rural areas, where a higher percentage of the population below the poverty line resides, are hardly being served. This is reflected in (see Table III.4) the fact that the Gini coefficient for cereal consumption is much lower for Urban India than that for Rural India.

Since the open market price (with procurement) is higher than the price prevailing in the abscence of compulsory procurement of cereals, the group which is left out of the PDS will incur definite losses. Assuming that the rural people are left out of the PDS, the losses incurred by them have been calculated using the expression $x(q'-q)$. As it can be seen from Table III.5 the relatively poorer people are worst hit due to this in terms of loss as a percentage of the average expenditure.

Table III.3 : Net benefits due to dual pricing

Expenditure group (Rupees) per capita per month	Consumption (Kgs) per capita per month		Welfare gain due to PDS (Rupees)		
	Wheat	Rice	in Wheat	in Rice	Total
			--------Rural India--------		
0 - 8	1.47	1.14	0.38	0.12	0.50
8 - 11	1.58	2.65	0.35	-0.09	0.26
11 - 13	1.25	3.17	0.45	-0.16	0.29
13 - 21	2.35	4.19	0.12	-0.30	-0.18
21 - 34	4.40	6.83	-0.50	-0.67	-1.17
34 - 75	6.79	9.24	-1.21	-1.01	-2.22
75 - 150	9.85	10.14	-2.13	-1.14	-3.27
150 - 250	12.60	10.60	-2.95	-1.20	-4.15
			-------Urban India-------		
0 - 265	5.78	6.32	-0.91	-0.60	-1.51
265 - 517	8.30	6.99	-1.67	-0.69	-2.36
517 - 724	10.00	6.38	-2.18	-0.61	-2.79
724 - 969	6.72	2.47	-1.19	-0.06	-1.25

Table III.4

Trends in the distribution of consumption expenditure on different items

Item	Gini Ratios		
	28th Round Oct.1973- June 1974	32nd Round July 1977 - June 1978	38th Round 1983
		Rural India	
Cereals	.14975	.12986	.12078
Total Food	.22139	.23278	.22678
Clothing	.57827	.58163	.60014
Total consumption Expenditure	.30736	.33622	.29660
		Urban India	
Cereals	.08167	.07456	.077959
Total Food	.22326	.24643	.24138
Clothing	.59051	.60670	.61789
Total consumption Expenditure	.30214	.34473	.32531

Source: Computed from NSS consumer expenditure survey data

Table III.5 : Welfare loss when left out of PDS network

Average exp. of the exp. group	Welfare loss in Wheat	Welfare loss in Rice	Welfare loss Total	Percentage loss
		------Rural India-------		
4.00	0.44	0.16	0.60	15.00
9.50	0.47	0.37	0.84	8.84
12.00	0.36	0.44	0.80	6.66
17.00	0.70	0.57	1.27	7.47
27.50	1.32	0.96	2.28	8.29
54.50	2.04	1.29	3.33	6.11
112.50	2.96	1.42	4.38	3.89
200.00	3.78	1.48	5.26	2.63

III.4: The Problem of Surplus Food Stocks

Food stocks with the government have been rising and the trend is likely to continue for the coming years. Along with the rising stocks the costs of carrying the stocks are also rising. To quote from the Economic survey (1985-86) - " Foodstocks reached record levels in June 1985 (29.17 million tonnes) and with a good Rabi harvest, stocks are likely to remain at high levels next year ..... excessive foodstocks are a financial burden and reflect both a problem of distribution and, perhaps as important, a supply problem..........".

The long run solution to this problem is to devise policies to increase the purchasing power through employment generation. But, in the short run the problem of stocks can be solved through effective food subsidy programmes. Part of the stocks could be exported if possible.

Thus, in the short run the government can be considered to have basically two options in disposing off the excessive food stocks.

1. Supply of subsidized food (or free food) through different social welfare programmes.

2. Selling the stocks in the open market.

Exporting of foodgrains is politically infeasible in the light of the conditions of poverty prevailing in the country. The second option is likely to depress the foodgrain prices which is *not in the interests of farmers.* Since food aid is targeted to the poor, who cannot afford to buy it, the amount distributed, free of cost, would just add to the existing consumption and is therefore likely to have the least effect on prices and on production.

The impact on prices can be analysed with the help of simple diagrams. For simplicity an inelastic aggregate supply function can be assumed. Let S be the total supply function and S' equal to S minus the government stocks, be the supply available for the market. Let D be the private demand function. Then the initial *equilibrium price is p .* If the government's stocks are distributed free of cost (see figure 3) the income effect shifts the demand curve D to D'. S is the relevent supply function. In so far as the income elasticity is less than unity, the amount of shift in the demand curve from D to D' will be less than the stocks of the government; in which case the new equilibrium price q will be less than the initial price p. The shift of the demand curve D *to D' is expected to be higher if the food aid is given* to the poor income groups. If the food aid is given to the rich then the shift will be lower.

In the case of *sale of foodstocks in the open market,* the intersection of the D curve and the S curve gives the new equilibrium price q (see figure 4). Hence, it is seen from these simple diagrams that the reduction in the price of foodgrains is likely to be greater in the case of foodstocks being sold in the open market. Infact, the results from the policy exercises are in confirmation with the arguments given above.

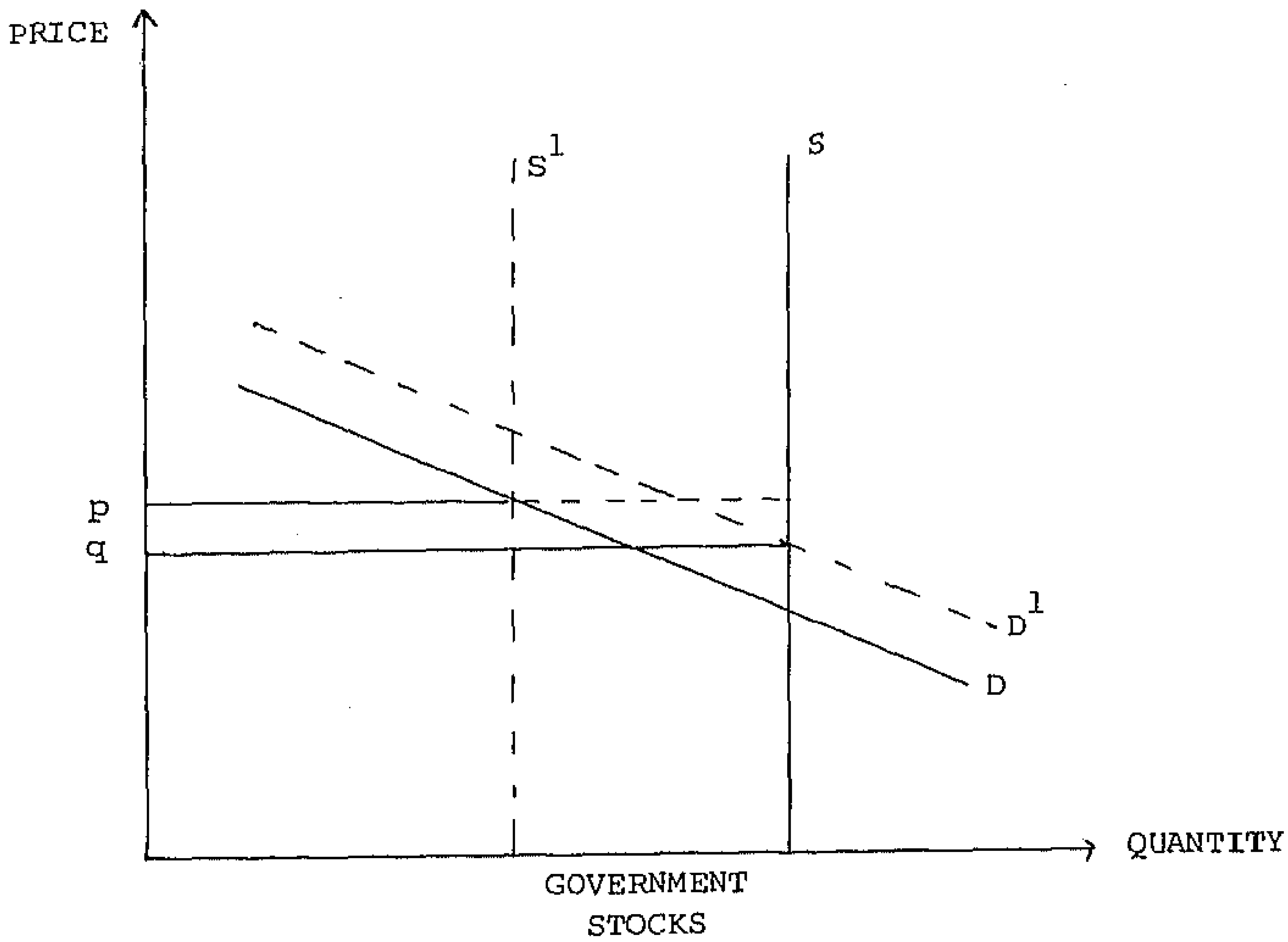


Figure - 3

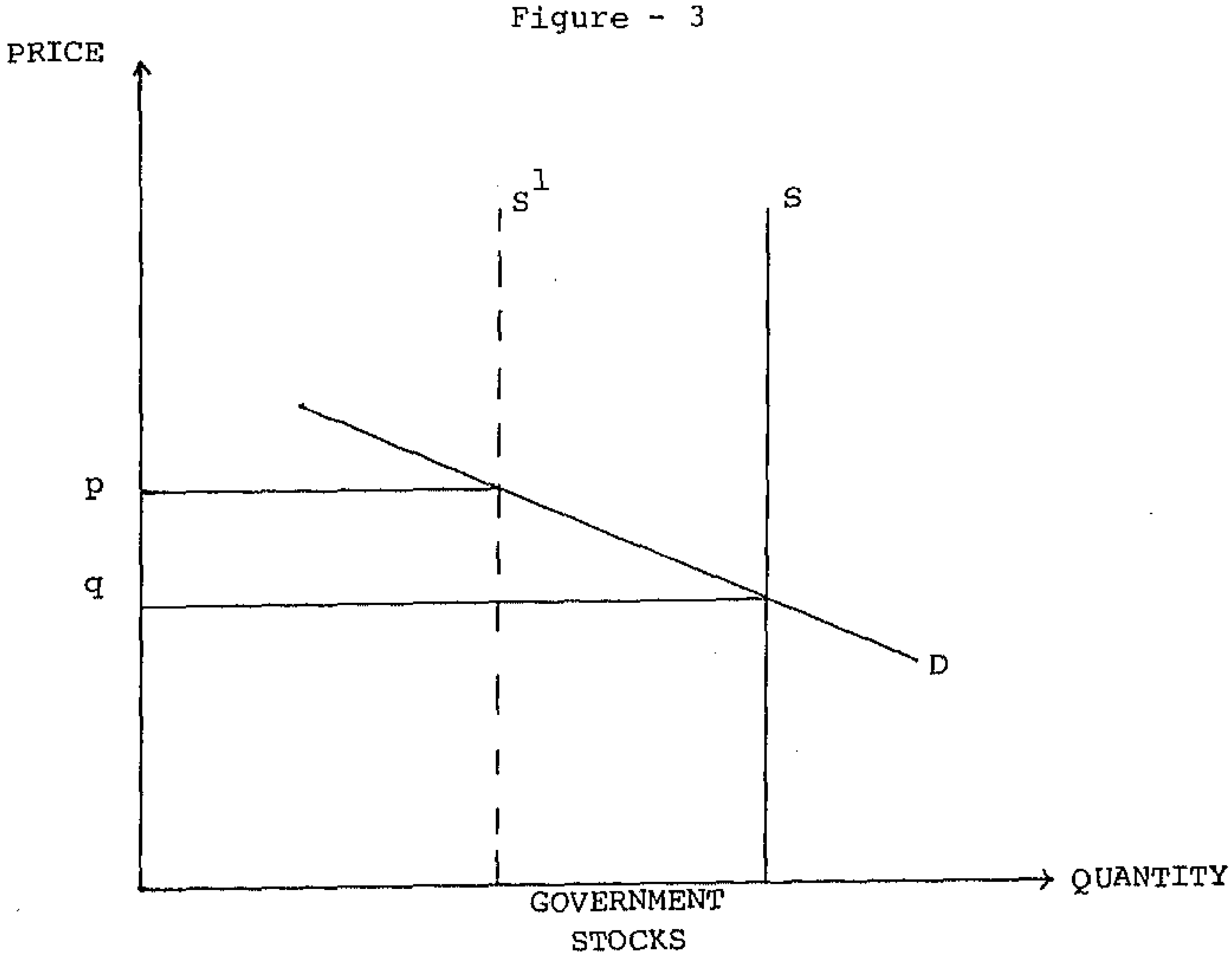


Figure - 4

In order to study the effects on the distribution of foodgrains the demand equations for each of the income groups have been calibrated using the price and expenditure elasticities as obtained from Murty and Radhakrishna (1981). These elasticities are tabulated in Appendix II. A log linear specification is used for these calibrated equations. In order to incorporate the effects of food aid on the demands, a subsidy amount, equal to the open market price times the quantity distributed, is added to the income of the relevant group. For example, if the foodgrains are to be distributed among the lowest three income groups, then the subsidy amount is divided among the income groups in proportion to their population. This ensures the per capita food aid to be equal across the groups.

The results from the simulation exercises (see Table III.6) reveal the following.

1. In the case of distributing foodgrains (10 million tonnes) free of cost there is approximately a 2% decrease in the price of foodgrains and the total supply decreases by 1%.

2. In the case of sale of foodstocks (10 million tonnes) in the open market, the open market price decreases by 16% . This is mainly due to the initial increase in the total supply of foodgrains in the market. This decrease in the price has an adverse effect on the supply of foodgrains (total supply decreases by 8%).

Table III.6 : Effects of disposing off surplus foodstocks

Policy change	Gini ratios for FG consumption Rural	Urban	Percentage change in FG Qty	FG price	GNP
1. No change	.189415	-.036384	-	-	-
2. Food aid	.154328	-.062275	-0.998	-2.28	-1.096
3. Sale of FG in the open mkt.	.177037	-.066143	-8.330	-16.178	-6.070

Explanatory Notes

1. FG denotes foodgrains.

2. Free food is assumed to be given to the lowest three income groups in both the rural and urban sectors.

Inequality in foodgrain consumption is reduced in both the situations 1 and 2 . But the reduction is much more in case 1.

Thus, it appears from the above exercises that out of the two options open to the government, the first option, namely the distribution of foodstocks in the form of food aid, is the best.

III.5 Estimates of Elasticities

III.5.1: Demand for Cereals

Any attempt to study the effects of government policies on consumers crucially depends on the estimated parameters of the demand relations like the price and income elasticities. These estimates are very essential for the design of appropriate price and income policies which affect the distribution of foodgrains among the people. Hence due importance has to be attached to the estimation of the demand relations. Appropriate functional forms have to be chosen and all the relevant explanatory variables used. For example, while estimating the demand for cereals the public distribution quantity for cereals should be one of the explanatory variables.

The study of the effects of PDS on the demand for commodities and the econometric implications of incorporating the ration quantity in the demand models [see Chetty and Haliburn (1985), Hausman (1985) and Chetty and Jha (1986)] has gained importance in recent times.

In the present study, aggregate demand equations for three major foodgrains, rice, wheat and jowar, have been estimated. The specification of the functional form is similar to the one appearing in the approximate linear version of the Almost Ideal Demand System (AIDS) developed by Deaton and Muellbauer (1980). Each equation was estimated using the ordinary least squares (OLS) method.

The functional form of AIDS is

$$w_i = \alpha_i + \sum_j \nu_{ij} \log p_j + \beta_i \log(m/P)$$

where

$$\log P = \alpha_o + \sum_k \alpha_k \log p_k + \tfrac{1}{2} \sum_{jk}\sum \log p_k \log p_j$$

w_i = share of expenditure on the ith commodity

m = total expenditure

By approximating P to a general price index the equation becomes linear and OLS technique can be used. In addition to the price and income variables, the shares of expenditure on the public distribution quantities of rice and wheat are also used as explanatory variables.

The expressions for finding the price and income elasticities are as given below.

$$e_{ij} = \frac{\text{(Coefficient of the jth commodity's price)}}{\text{(share of expenditure on the ith commodity)}} - \delta_{ij}$$

$$= \nu_{ij}/w_i - \delta_{ij}$$

Where e_{ij} is the elasticity of commodity i with respect to the jth commodity's price and

$$\delta_{ij} = 0 \text{ for } i \neq j$$
$$= 1 \text{ for } i = j$$

Income elasticity of the ith commodity is given as

$$e_{im} = \beta_i / w_i + 1$$

Estimates using the data for the period 1961-62 to 1978-79 are as follows.

Rice

$$S_1 = 0.49 + 0.056 \log p_1 - 0.035 \log p_2 - 0.078 \log \left(\frac{M}{P}\right) - 2.585 SD1$$

(3.08)	(-1.95)	(-3.73)	(-2.32)
[-0.554]	[-0.279]	[0.386]	[-0.206]

$\bar{R}^2 = 0.52$ D.W. = 1.95

Wheat

$$S_2 = .158 + .01175 \log p_1 + .00647 \log p_2 - .034 \log \left(\frac{M}{P}\right) + 1.15\ SD2$$

(1.514)	(1.22)	(-1.014)	(2.69)
[0.15]	[-0.92]	[0.567]	[0.32]

$\bar{R}^2 = 0.71$ D.W. = 1.614

Jowar

$$S_3 = .255 - .03 \log p_1 + .0146 \log p_2 + .023 \log p_3 - .045 \log \left(\frac{M}{P}\right)$$

(-1.79)	(0.926)	(1.72)	(-2.13)
[-0.89]	[0.426]	[-0.315]	[-0.323]

$\bar{R}^2 = 0.45$ D.W = 1.77

where

S_1, S_2, S_3 are the shares of expenditure on free market purchase of rice wheat and jowar respectively; p_1, p_2, p_3 are the prices and SD1, SD2 are the shares of expenditure on public distribution quantities of rice and wheat respectively. (M/P) is the total private final consumption expenditure deflated by the general price index.

( ), [ ] contain t-values and elasticities respectively.

A detailed report on the data sources and the units is given in the Appendix.

Demand equations were estimated using the linear and log linear specifications also. The results are presented below.

Log Linear specification

Rice

$$x_1 = 7.71 - 0.09\ p_2 - .356\ p_1 + .577\ M - .135\ PD_1$$

(-0.56) (-1.708) (4.32) (-1.69)

$\bar{R}^2 = 0.72$ D.W. = 2.0

Wheat

$$x_2 = 4.21 - 0.393\ p_2 + 0.139\ p_1 + .503\ M + .204\ PD_2$$

(-1.54) (0.465) (2.75) (1.37)

$\bar{R}^2 = 0.84$ D.W. = 1.64

Jowar

$$x_3 = 12.12 - 0.204\ p_1 - 0.076\ p_2 - 1.097\ p_3 + 0.535\ M$$

(-0.64) (-0.698) (-2.94) (5.38)

$\bar{R}^2 = 0.96$ D.W. = 1.56

Linear specification

Rice

$$x_1 = 35556.4 - 59.135\ p_1 - 23.74\ p_2 + 0.44\ M - 1.302\ PD_1$$

(-1.96) (0.42) (4.16) (-1.13)

[-0.17] [-0.07] [0.398] [-0.10]

$\bar{R}^2 = 0.66$ D.W. = 1.94

Wheat

$$x_2 = 10106.4 + 91.81\ p_1 - 107.13\ p_2 + 0.23\ M + 1.06\ PD_2$$

$$\begin{matrix} & (1.88) & (-2.28) & (2.886) & (1.99) \\ & [0.456] & [-0.561] & [0.358] & [0.282] \end{matrix}$$

$\bar{R}^2 = 0.82 \quad D.W = 1.64$

Jowar

$$x_3 = 140411.0 + 141.316\ p_1 - 881.3\ p_3 + 0.634\ M$$

$$\begin{matrix} & (0.31) & (-1.84) & (2.12) \\ & [0.19] & [-1.23] & [0.27] \end{matrix}$$

$\bar{R}^2 = 0.85 \quad D.W. = 1.10$

where

x_1 , x_2, x_3 are the aggregate free market demands for rice, wheat and jowar respectively and p_1, p_2, p_3 their respective prices, M is the total private final consumption expenditure and PD_1 and PD_2 are the public distribution quantities of rice and wheat respectively.

The income and price elasticities obtained from the different specification are summarised below.

In the case of rice and wheat there is not much variation in the income elasticities, but the own price elasticities seem to vary quite a bit for the different specifications. In the case of jowar the share equations give rise to a negative income elasticity while the linear and log linear specifications imply very high own price elasticities.

Elasticities

Functional Form	Rice		Wheat		Jowar	
	Own Price	Income	Own Price	Income	Own Price	Income
Share Equation	-0.554	0.386	-0.92	0.567	-0.315	-0.323
Linear	-0.17	0.398	-0.561	0.358	-1.23	0.27
Log Linear	-0.356	0.577	-0.393	0.503	-1.097	0.535

In order to have a cross check income elasticities were estimated using the NSS (28th Round ,1973-74) consumer expenditure survey data. The following functional form was used.

$w_i = a_i + b_i \log m$ i=Rice, Wheat & Jowar

Where

w_i = share of household percapita consumption expenditure on the ith commodity and

m = House hold percapita consumption expenditure on all goods

Income elasticities

	Rice	Wheat	Jowar
Rural India	0.6025	0.7311	0.4649
Urban India	0.4609	0.5014	0.17904

All the coefficients were significant at 10% level of significance and $\bar{R}^2$ were reasonably good ranging from 0.56 to 0.79.

It can be seen that the income elasticity of demand for jowar is positive in both the urban and rural areas. This indicates that jowar is not an inferior good. The share equation specification does not seem to fit the jowar data well, which has yielded a negative income elasticity. NSS estimates compare well with those obtained from time series data in the case of rice and wheat.

The estimates of the elasticities are not very different from those available in the literature except for the fact that the own price elasticity for wheat is quite high. The variation in the magnitudes of elasticities found in the literature could be due to several reasons such as use of different data sets, different specifications of the functional form, different methods of estimation etc. In a study by Binswanger and Swamy (1983) demand elasticities for rice, wheat and inferior cereals have been estimated with aggregate time series data using the complete demand systems approach. Data for twenty years and ten Indian States, (for the period 1956-75) were pooled so that the number of observations was 200. Ration quantities were not used as explanatory variables. In another study by Chetty and Haliburn (1985) based on aggregate time series data price and income elasticities for rice and wheat were obtained while taking the ration quantities as explanatory variables, using the ordinary least squares method. A detailed list of all these elasiticities is given in Table III.7 below.

Table III.7

Comparison of Demand Elasticities

Author	Specification	Rice			Wheat		
		Own Price	Cross Price	Income	Own Price	Cross Price	Income
Chetty & Haliburn* (1985)	linear/ loglinear	-0.3234	-	0.480	-0.609	0.538	0.302
Binswanger & Swamy (1983)	Complete demand system	-.5815	0.1275	0.942	-0.2259	0.2266	1.077
Current Estimates*	Share equation	-0.554	-0.279	0.386	-0.920	0.15	0.560

Note

'*' indicates that Free market demand has been used as the dependent variable and ration quantity is one of the explanatory variables.

Comparative Statics of demand functions under partial rationing*

In order to interpret the empirical estimates of the demand functions it is useful to derive analytically the expressions for the derivaties of the demand functions with respect to certain parameters. Some notations have to be introduced for this purpose.

Let there be n goods in the economy. For simplicity it can be assumed that partial rationing applies only to the first good. That is, a fixed quota D of the first good can be bought in the ration shop at a fixed ration price $\bar{p}_1$ and the rest of the demand for this good is met in the open market at a higher price p_1. Let $x = (x_1,\ldots,x_n)$ denote the vector of demands, $p = (p_1,\ldots,p_n)$ the vector of prices associated with x and m the lumpsum income of a typical consumer. The analysis presented below is restricted to the case where the total demand for the first good is greater than the ration quota ($x_1 > D$).

For any consumer, the expenditure function gives the minimum cost of attaining a given level of utility. Under partial rationing the expenditure function is given as

$$\bar{c}(p,\bar{p}_1,D,u) = \underset{x}{\text{Min}}\{p.x - (p_1 - \bar{p}_1)D/u(x)>u\} \qquad (1)$$

In the absence of rationing the expenditure function is obtained as

$$c\ (p,u) \ = \ \underset{x}{\text{Min}}\ \{p.x\ /\ u(x) > u\} \qquad (2)$$

---

* Similar results for the case of complete rationing have been obtained in Neary and Roberts (1980).

It can be checked that these expenditure functions are increasing, concave and linearly homogenous in all prices including $\bar{p}_1$. The compensated or the Hicksian demand functions can be obtained from the partial derivatives (Shephard's lemma) of the expenditure function. Let $\tilde{x}^c$ denote the vector of compensated demands under rationing and $\tilde{x}$ the vector of compensated demands for the no rationing case.

$$\tilde{x}_i^c(D,\bar{p}_1,p,u) = \bar{c}_{p_i} \;\forall i = 2,\ldots,n \tag{3}$$

$$\begin{aligned}\tilde{x}_1^c(D,\bar{p}_1,p,u) &= \bar{c}_{p_1} + \bar{c}_{\bar{p}_1} \\ &= \bar{c}_{p_1} + D\end{aligned} \tag{4}$$

It can be easily checked that

$$c(p,u) \equiv \bar{c}(p,\bar{p}_1,D,u) + (p_1 - \bar{p}_1)D \tag{5}$$

This means that the solution for the cost minimization problem in the no rationing case will not differ from that in the case of rationing if the consumer is given a lumpsum subsidy amounting to $(p_1 - \bar{p}_1)D$ (see Chetty & Jha (1986)).

Differentiating (5) with respect to p yields,

$$\tilde{x}_i(p,u) = \tilde{x}_i^c(p,\bar{p}_1,D,u) \qquad \forall\, i=1,\ldots,n \tag{6}$$

Changes in the ration quota

The effect of a change in the ration quota on the compensated demands can be obtained by differentiating (6) with respect to D

$$0 = \frac{\partial \tilde{x}^c}{\partial D} \tag{7}$$

Let x^c and x denote respectively the vectors of Marshallian demands with and without partial rationing. Using the following identity it is easy to obtain the effect of a change in the ration quota on the demands.

$$\tilde{x}^c(p,\bar{p}_1,D,u) \equiv x^c(p,\bar{p}_1,D,\bar{c}(p,\bar{p}_1,D,u)) \qquad (8)$$

Differentiating (8) partially with respect to D

$$\frac{\partial \tilde{x}^c}{\partial D} = \frac{\partial x^c}{\partial D} + \frac{\partial x^c}{\partial m}\frac{\partial \bar{c}}{\partial D}$$

$$= \frac{\partial x^c}{\partial D} - (p_1-\bar{p}_1)\frac{\partial x^c}{\partial m} \qquad (9)$$

Using (7), equation (9) can be reduced to

$$\frac{\partial x^c}{\partial D} = (p_1-\bar{p}_1)\frac{\partial x^c}{\partial m} \qquad (10)$$

This equation is similar to the Slutsky equation for a price change, the substitution effect being zero in this case.

<u>Changes in income and prices</u>

It can be shown that the solution to the utility maximization problem subject to the budget constraint under no rationing

$$p.x - (p_1 - \bar{p}_1)D \leq m$$

is identical to the solution of the problem with the budget constraint under rationing

$$p.x \leq m + (p_1 - \bar{p}_1)D$$

Therefore,

$$x^c(p,\bar{p}_1,D,m) \equiv x\ (p,\bar{p}_1,m+(p_1-\bar{p}_1)D) \qquad (11)$$

Using this identity it is possible to derive the expressions for the changes in the demands under rationing in terms of the changes in the demands under no rationing.

Differentiating (11) with respect to m

$$\frac{\partial x^c}{\partial m} = \frac{\partial x}{\partial m} \tag{12}$$

This means that the income derivative remains the same for both the cases of rationing and no rationing. Given (12) we can write equation (10) as

$$\frac{\partial x^c}{\partial D} = (p_1 - \bar{p}_1)\frac{\partial x}{\partial m} \tag{13}$$

Differentiating (11) with respect to p yields

$$\frac{\partial x^c}{\partial p_i} = \frac{\partial x}{\partial p_i} \qquad i = 2,\ldots,n \tag{14}$$

$$\frac{\partial x^c}{\partial p_1} = \frac{\partial x}{\partial p_1} + D\frac{\partial x}{\partial m} \tag{15}$$

This implies that if the first good is normal then the magnitude of its own price elasticity is less under rationing than that under no rationing. The cross price elasticity will be the same for both the cases.

<u>Sign of the derivative with respect to ration quota</u>

From equation (13) it is obvious that for normal goods $\frac{\partial x^c}{\partial D}$ is positive. It will be of interest to know if the sign of the derivative of the free market demand with respect to the ration quota can be determined analytically. Let F denote the free market demand of the first good under rationing.

$$F = x_1^c - D$$

Therefore,

$$\frac{\partial F}{\partial D} = \frac{\partial x_1^c}{\partial D} - 1$$

i.e.,

$$\frac{\partial F}{\partial D} < 0 \quad \text{if} \quad \frac{\partial x_1^c}{\partial D} < 1$$

$$\geq 0 \quad \text{otherwise}$$

From equation (13) it is clear that $\frac{\partial x_1^c}{\partial D}$ will be less than one if the income effect $\frac{\partial x_1}{\partial m}$ is weak enough and/or $(p_1 - \bar{p}_1)$ is small enough (ie. ration price is very close to the open market price).

From the current empirical estimates, it has been noted that $\frac{\partial F}{\partial D} < 0$ in the case of rice and $\frac{\partial F}{\partial D} > 0$ in the case of wheat. It is interesting to note that the difference between the ration price and the open market price has been observed to be smaller in the case of rice than that in the case of wheat. This partly explains the negative coefficient obtained in the case of rice. However, it is impossible for $\frac{\partial F}{\partial D}$ to be less than −1, since $\frac{\partial x_1^c}{\partial D}$ is always positive for normal goods. The high negative coefficient obtained in the case of rice could be due to aggregation problems.

III.5.2 Supply of Cereals

Government's pricing policies affect the farmers' decisions regarding the levels as well as the composition of outputs. In order to arrive at a proper policy mix it is very important to know the output responses to changes in the variables like procurement price, irrigated area, relative prices of different crops etc. In an attempt to derive the elasticity of output with respect to these variables, supply equations for the cereals rice, wheat and jowar have been estimated using single equation models. Most of the earlier literature on agricultural supply response has concentrated on the estimation of models related to acreage response. A review of literature on the agricutural supply response and estimates of acreage response equations for India can be found in a study by Narayana N.S.S. and Kirit Parikh (1981). In the present study output response equations have been estimated.

In the estimates given below the following functional form has been used for each of the supply equations: (period of data: 1961-62 to 1978-79)

$$Q = a + b\ P_{-1} + c\ SP_{-1} + d\ IR + c\ R$$

Where

Q = the total production (or supply) of the cereal

P_{-1} = wholesale price index of the crop with a one period lag

SP_{-1} = weighted price index of the major production substitutes of the crop with a one period lag

IR = percentage of area under irrigation out of the total cropped area of the cereal

R = crop specific rainfall index

According to this specification supply adjusts with a one period lag to the prices, depending on the prevailing weather conditions and irrigation level. The variable P_{-1} is the weighted average of the procurement price and the open market price (each lagged by one year). Under the government's procurement policies the farmer faces two prices for his output. He will have to sell a part of his output at the procurement price fixed by the government and the rest at the open market price. In effect, the farmer receives a weighted average price for his total output sold. In the case of jowar since the quantity procured is very small, the open market price was used instead of the weighted average price. Barley and gram were used as the major production substitutes for wheat; ragi, jute and mesta for rice; and bajra and maize for jowar. (The list of substitutable crops for each state is given in Appendix IV).

The following are the estimated supply equations:

Rice

$$Q = -50992 + \underset{\substack{(4.79)\\ [.4968]}}{194.51}\, P_{-1} - \underset{\substack{(-3.25)\\ [-.4281]}}{162.775}\, SP_{-1} + \underset{\substack{(3.19)\\ [1.521]}}{1615.2}\, IR + \underset{\substack{(5.61)\\ [.6685]}}{270.8}\, R$$

$\bar{R}^2 = 0.92$ D.W = 2.58

Wheat

$$Q = -13444 + \underset{\substack{(3.386)\\ [.7443]}}{151.6}\, P_{-1} - \underset{\substack{(-1.914)\\ [-2.288]}}{49.58}\, SP_{-1} + \underset{\substack{(3.13)\\ [1.017]}}{404.11}\, IR + \underset{\substack{(2.494)\\ [.204]}}{48.97}\, R$$

$\bar{R}^2 = 0.89$ D.W = 2.05

Jowar

$$Q = -886.78 + \underset{(1.366)}{.379}\, Q_{-1} + \underset{\substack{(1.2664)\\ [.366]}}{576.631}\, IR + \underset{\substack{(1.152)\\ [.2314]}}{19.11}\, P + \underset{\substack{(1.051)\\ [.2618]}}{24.66}\, R$$

$$\underset{\substack{(-7.04)\\ [-.1413]}}{-11.37}\, SP$$

$\bar{R}^2 = .2133$ D.W. = 1.77

Note

Q_{-1} is the lagged output
( ) contains t values
[ ] contains elasticities

The equations give reasonable estimates of the coefficients. All the coefficients are statistically significant and $\bar{R}^2$ values are good except for the jowar equation. The price elasticity of output for rice (0.4968) is lower than that for wheat (0.7443). For rice the elasticities of output with respect to rainfall and irrigation variables (1.52 and 0.668 respectively) are greater than those for wheat (1.017 and 0.204 respectively). These magnitudes will have their implications for the pricing and distribution policies. For example, a decrease in the procurement is likely to reduce (due to a reduction in the weighted average price) the output much more in the case of wheat than in the case of rice. Magnitudes of the elasticities with respect to the substitute crops' price indicate that the acreage for rice is more responsive to the substitute crops' price than that for wheat. This implies that it is easier to shift the rice cultivators to other crops or vice-versa through pricing policies. Based on the elasticities with respect to irrigated area it can be said that the government's investment programs regarding the provision of irrigation facilities are likely to yield better results in the case of rice than in the case of wheat with all other variables remaining unchanged. The elasticity of output with respect to rainfall is higher for rice than that for wheat. This suggests that rice crop depends more on rainfall. This is reflected in the fact that the irrigated area for rice (38.6% of the total area cropped under rice) is much less than that of wheat (58.2%). These figures in the parantheses were obtained as averages for the period between the late 1960's and the late 1970's.

The estimates of output elasticities of rice compare well with those estimated by RajKrishna and RayChoudhuri (1980) (0.45 with respect to the lagged price and 0.62 with respect to rainfall). In the case of wheat the estimates are slightly higher than those obtained in RajKrishna and RayChoudhuri (1980) and RajKrishna and AjayChhibber (1983).

CHAPTER IV

Effects of Certain Policies Related to the Textile Industry

IV.1 : Introduction

In this chapter the focus is mainly on answering the following questions.

1. What are the effects of changes in tax policies on the total consumption of cloth and its distribution across income groups? For example, what is the result of a reduction in the tax on synthetics?

2. Do changes in taxes influence the choice of technique in the textile industry?

3. What is the impact of increasing the supply of cloth through government production? For example, what are the effects on the total supply of cloth and the employment generated in the textile industry due to increasing production in sectors using labour intensive techniques of production?

4. What is the impact of changes in foodgrain price on the demand for cloth?

In spite of the government's interventions in the textile industry in several forms, market forces are the major determinants of the demand for and supply of textiles. Although the government's role as a producer of textiles is really small, it can affect private production through its various fiscal and licensing policies. For example, it can affect, through suitable taxes, the sectoral allocation of the total production of cloth between the capital intensive mill sector and the labour intensive decentralized sector. The current policy concerns of the government regarding the textile industry include the improvement of per capita consumption levels of cloth and protection of the labour intensive segment of the industry keeping in view the objective of providing more employment in the economy.

The textile policy introduced in March 1981, inter alia, emphasised a multifibre approach for harmonious growth of all sectors of the industry and accorded priority for the handloom sector. According to the multifibre approach, the taxes on man-made fibre fabrics are kept high so that only the rich can afford to buy whereas the cotton fabrics are subsidized which will benefit the poor. This is likely to yield good results provided the rich people's demand for synthetics is highly inelastic to price and the poor people's demand for cotton fabrics is highly price elastic. But, in view of the fact that the consumers' preferences (in all income groups) have shifted away from cottons to synthetics, the multifibre base might have to be widened to cater to all sections of the society. That is, it may not be advisable to restrict the synthetics market to the rich alone. Recent cosumption figures for cloth (see Table IV.1 below) show that consumers' preferences have shifted away from cotton to non-cotton and more towards the mixed variety. The per capita availability of cloth has remained stable (see Table IV.2) from the early 1970's to the early 1980's without any appreciable increase. While the per capita availability of cotton cloth has gone down, the increase in the percapita availability of

Table IV.1

Percapita Consumption of Textiles(All India)

Year	Cotton	Non Cotton	Mixed
1977	11.60	0.71	0.94
1978	11.60	0.84	1.15
1979	11.46	0.92	1.27
1980	10.57	1.21	1.66
1981	9.57	1.01	1.73
1982	10.04	1.21	2.26
1983	10.12	1.44	2.14

Source: Consumer Purchases of Textiles, Textile Committee.

Table IV.2

Percapita availability of cloth

Year	Cotton Fabrics	Man Made Fibre Fabrics	Total Cloth
	metres		
1970	13.56	2.10	15.66
1971	12.36	2.31	14.67
1972	13.12	2.14	15.26
1973	11.98	2.07	14.05
1974	12.80	1.93	14.73
1975	12.47	2.20	14.67
1976	11.23	2.78	14.01
1977	9.50	4.47	13.97
1978	10.11	5.30	15.41
1979	10.10	5.02	15.12
1980	11.08	4.25	15.33
1981	10.66	4.75	15.41

Source: Man Made Fibre Statistics (1981)

Table IV.3

Consumption pattern of textiles accross Income Groups

Sl.No.	Income Group (Monthly per capita expenditure range in Rupees)	Per capita consumption of Textiles (meters)			
		Cottons		Synthetics*	
		Rural	Urban	Rural	Urban
1.	0-34	9.51	8.68	0.65	1.83
2.	34-43	10.36	9.60	1.26	2.83
3.	43-55	11.72	10.48	2.00	4.36
4.	55-75	13.70	12.70	3.07	5.93
5.	75 and above	7.89	12.85	1.03	7.80

Source : Computed from the Textile Committee's Panel Data (1980-81)

* Synthetics includes Polyesters, Polyester-Cotton and other blended varieties.

synthetics has compensated for this.

The per capita consumption of cottons and synthetics by the rich (in both rural and urban areas) is higher than that by the poor (see Table IV.3). The per capita expenditure on cottons is nearly of the same magnitude in both the urban and rural regions. Whereas, the per capita expenditure on synthetics of the urban groups is almost twice that of the rural groups. It is also seen that the share of expenditure on synthetics out of the total expenditure on cloth is high for rich income groups.

For the purposes of this chapter, the textile industry has been classified into two sectors, the mill sector and the decentralized sector. The decentralized sector consists of the powerloom and the handloom sectors. Henceforth the mill sector will be referred to as the M-sector and the decentralized sector as the D-sector. The M-sector adopts a capital intensive technique whereas the D-sector adopts a less capital intensive one. Production of each variety of cloth, cotton and synthetic, is divided between the M-sector and the D-sector. Thus there are four different supply equations, one for each type of cloth with each type of manufacture. The recent trend in the production of textiles in the different sectors of production is given in Table IV.4 below. It is seen here that there has been a fall in the output of cotton cloth from the mill sector, whereas, the output from the D-sector has been increasing. This is due to the huge growth of the powerlooms which are part of the D-sector. In the case of synthetics, output has been growing in both the M-sector and the D-sector, but at a faster rate in the M-sector.

Table IV.4

Recent trends in the production of Textiles

Year	Production of cloth (Million metres)			
	Cotton cloth		Synthetic cloth*	
	M-Sector	D-Sector	M-Sector	D-Sector
1970-71	4055	3547	109	1012
1975-76	3961	4130	258	1038
1980-81	3434	4934	734	1886
1981-82	2923	5060	885	2113
1982-83	2393	5560	739	1922
1983-84	2704	6037	783	2234

Source : Economic Survey (1985-86)

* Synthetic cloth includes man-made fibre fabrics and mixed/blended varieties.

Nevertheless, the level of output in the D-sector is far higher than that in M-sector.

The estimated supply elasticities are as follows* :

	Cottons		Synthetics	
	M-sector	D-sector	M-sector	D-sector
Elasticity with respect to own price	0.906	0.262	5.86	1.443

It is in general difficult to distinguish between mill-made and powerloom-made cloth although cloth produced from handlooms can easily be identified. Thus, there is a single demand equation and also a single price for a particular variety of cloth irrespective of the sector of manufacture. The aggregate demand elasticities are given in the following table :

Aggregate Demand Elasticities**

	Elasticities with respect to		
	Price of Cottons	Price of Synthetics	Income
Cottons	-0.990	0.407	0.290
Synthetics	0.745	-0.718	0.507

The own price elasticity for cottons is higher in magnitude than that for synthetics. The income and cross price elasticities for synthetics are higher in magnitude than those for cottons.

* See Section IV.5.2 for the estimated equations.

** See Section IV.5.1 for the estimated equations.

Demand equations have been calibrated for each of the ten income groups in order to capture the distribution effects of policy changes. The elasticities for each of these groups are provided in Table IV.5 below.

Table IV.5: Income group wise demand elasticities for textiles

Income Groups	Cottons			Synthetics		
	Own Price	Price of Synthetics	Income	Own Price	Price of Cottons	Income
RURAL						
1	-1.145	0.47	0.15	-1.162	1.68	0.51
2	-1.051	0.43	0.20	-0.84	0.87	0.38
3	-0.929	0.38	0.23	-0.53	0.55	0.31
4	-0.795	0.33	0.25	-0.34	0.36	0.26
5	-1.38	0.57	0.75	-1.02	1.06	1.34
URBAN						
6	-1.25	0.52	0.18	-1.85	1.92	0.62
7	-1.13	0.47	0.22	-1.20	1.24	0.55
8	-1.04	0.43	0.25	-0.78	0.81	0.46
9	-0.86	0.35	0.27	-0.57	0.59	0.44
10	-0.85	0.35	0.52	-0.43	0.45	0.64

In the case of cottons, the demand elasticities (with respect to own price as well as with respect to the price of synthetics) of the poor income groups are higher in magnitude. But, the elasticity of demand with respect to income is of higher magnitude for the richer income groups. In the case of synthetics the magnitudes of elasticities (with respect to all the variables) are higher for the poorer income groups. The above characteristics hold for both the rural and urban regions.

The distribution of cloth accross income groups is judged by the computed Gini Ratios as well as the distributional characteristic given by

$$x^*/x = \sum_h \beta^h x^h / \sum_h x^h$$

where x^h denotes the consumption of cloth by the hth income group and β^h is the welfare weight attached to this group. The higher the ratio x^*/x, the better the didtribution is, since the poorer classes are given greater weights. The welfare weights are computed using the following standard technique used in cost benefit analysis. Let $W = W(v^1, \ldots, v^H)$ be the Bergson-Samuelson social welfare function where v^h is the indirect utility function of the hth individual. Assuming the marginal utility of income to be a constant elasticity function of the income for given prices,

$$\frac{\partial v^h}{\partial m^h} = k(m^h)^{-\sigma} \quad \text{for some } k, \sigma$$

where m^h is the income of hth income class.

The welfare weight for class h is given by

$$\beta^h = \frac{\partial W}{\partial v^h} \frac{\partial v^h}{\partial m^h}$$

Assuming

$$\frac{\partial W}{\partial v^h} = 1 \quad \text{for all } h, \quad \beta^h = k(m^h)^{-\sigma}$$

The constant k is chosen such that $\beta^h = 1$ for the poorest income group. σ is interpreted as the inequality aversion parameter. For the current empirical exercises, the welfare weights used (corresponding to $\sigma = 1$) are as given in the table below.

Table IV.6: Welfare weights (for $\sigma = 1$)

	Income Groups				
	1	2	3	4	5
Rural	1.0	.69	.54	.42	.24
Urban	.94	.69	.54	.41	.21

IV.2: Effects of Tax Policies

Taxes on commodities, apart from being a source of revenue for the government, serve several other policy purposes. For example, taxes/subsidies can be used to alter the relative price structure in favour of production in a specific sector. By providing suitable fiscal incentives production can be encourged in a sector using a desirable technique of production. Through changes in relative prices and hence in income distribution, taxes also affect the consumption distribution of the goods accross different income groups.

To achieve an increase in per capita consumption, the new textile policy (1985) recommends rationalisation of fiscal levies on man-made fibres and yarns as well as on inputs for the production of such fibres. If the tax rates on synthetics are reduced, more people can afford them. Thus, synthetic cloth may no longer remain a rich man's fabric. This implies a widening of the multifibre base.

One obvious way of increasing cloth consumption is through an increase in income. But an interesting question is, in what direction should the relative prices of different varieties of cloth change in order to achieve an increase in the total cloth consumption. At the same time, one has to keep track of the effect on the distribution of cloth. Hence, it would be of interest to obtain the effects of tax changes on government's revenue, the total consumption of cloth and its distribution accross income groups. Also changes in output due to tax changes will have their implications for total employment. For this purpose computations have been made and the results are given below.

For the simulation exercises of this section, it is assumed that the taxes apply only on the mill sector cloth. That is, the price term in the corresponding supply equations is taken as (p-t) where p is the market price and t the specific tax rate. A list of the policy simulations is given in the table below.

Table IV.7: List of tax policy exercises

S.No	Policy Description
1.	100% increase in tax on Cottons
2.	100% increase in tax on Synthetics
3.	100% decrease in tax on Cottons
4.	100% decrease in tax on Synthetics

Effects on Employment

Using the labour-output ratios for each of the sectors the total employment generated in the textile industry can easily be computed for the equilibrium levels of output. For each of the tax policy changes, the effects on employment are examined by computing the percentage change in the employment generated per unit percentage change in the government's budget deficit. As mentined earlier, only the M-sector cloth is taxed (for both cottons and synthetics) in this model. An increase in the tax rates leads to an increase in employment. This is because an increase in the tax rate discourages production in the M-sector which is capital intensive and encourages production in the D-sector which is labour intensive (see Table IV.8 below). In other words, production from the M-sector decreases as the tax rate is increased and due to the consequent rise in the equilibrium price, output from the D-sector goes up. Surprisingly, a decrease in the tax rates also leads to an increase in employment though the increase is less in this case. This can be explained by the pattern of changes in the output mix of the different sectors. Due to a decrease in the tax rate, output from the M-sector increases while there is a decrease in the output from the other sectors. The magnitudes of these changes are such that the increase in employment due to a rise in the M-sector output dominates the decrease in employment from other sectors.

It can be observed that the increase in employment is higher with a decrease in tax on cottons than the increase obtained from a decrease in tax on synthetics. Also, an increase in the tax on synthetics leads to a higher increase in employment than the increase obtained from an increase in the tax on cottons. Thus, discouraging the production of synthetics (by increasing tax on synthetics) and encouraging the production of cottons (by decreasing tax on cottons) will serve well the objective of employment generation.

Table IV.8

Effects of taxes on Employment and output

Policy Change	Changes in Output (Percent): Cottons M	Cottons D	Cottons Total	Synthetics M	Synthetics D	Synthetics Total	Total cloth	Change in Prices (Percent): Cottons	Synthetics	%ΔEmployment / %ΔDeficit	Overall Capital intensity of the textile industry (Rs.lakhs/employee)
1.	-8.42	2.32	-3.21	1.16	1.62	1.48	-1.88	4.35	2.31	1.827	0.1315
2.	0.29	0.13	0.21	-11.31	1.40	-1.29	-0.52	2.08	4.45	2.808	0.1303
3.	5.50	-2.24	1.75	- 1.90	-1.12	-1.35	0.87	-1.50	-0.56	0.287	0.1366
4.	-1.40	-1.76	-1.57	13.15	-1.84	2.57	-0.39	-0.28	-4.31	0.103	0.1375
No change	-	-	-	-	-	-	-	-	-	-	0.1360

Note :

$\frac{\%\Delta \text{Employment}}{\%\Delta \text{Deficit}}$ denotes the percentage change in the employment generated in the textile industry per unit percentage change in the government's budget deficit.

Effects on Output and Distribution

With an increase in tax on cottons the total cloth output decreases much more than with an increase in tax on synthetics. A tax decrease on cottons leads to an increase in the total cloth output while a tax decrease on synthetics results in a decrease in total cloth output. This can be explained with the help of simple diagrams (see figures IV.1 to IV.4 below). As mentioned earlier, if p is the market price, the price received by the producer will be p-t, where t is the tax rate. Thus a decrease in the tax rate amounts to an outward shift in the supply curve. In the figures below, the supply curves are labelled 'S' and the demand curves 'D'. The shifted curves are denoted with the superscript '1'. Because the change in the income variable is very small it is assumed that there is no shift in the demand curve due to income effect. In the case of a decrease in the tax on synthetics, since the demand for synthetics is not very elastic, the increase in the output of synthetics, due to an outward shift in the supply curve, is very small (see figure IV.1). Nevertheless, there is a fall in the price of synthetics. Due to this the demand curve for cottons shifts down (cross price effect) considerably. This causes a decrease in the output of cottons (see figure IV.2). The net effect is a fall in the total cloth output. In the case of a decrease in the tax on cottons, since the demand for cottons is very elastic, the increase in output of cottons, due to an outward shift in the cottons supply curve, is large (see figure IV.3). Also, due to the substitution effect caused by a fall in the price of cottons, the demand curve for synthetics (see figure IV.4)

DECREASE IN TAX ON SYNTHETICS

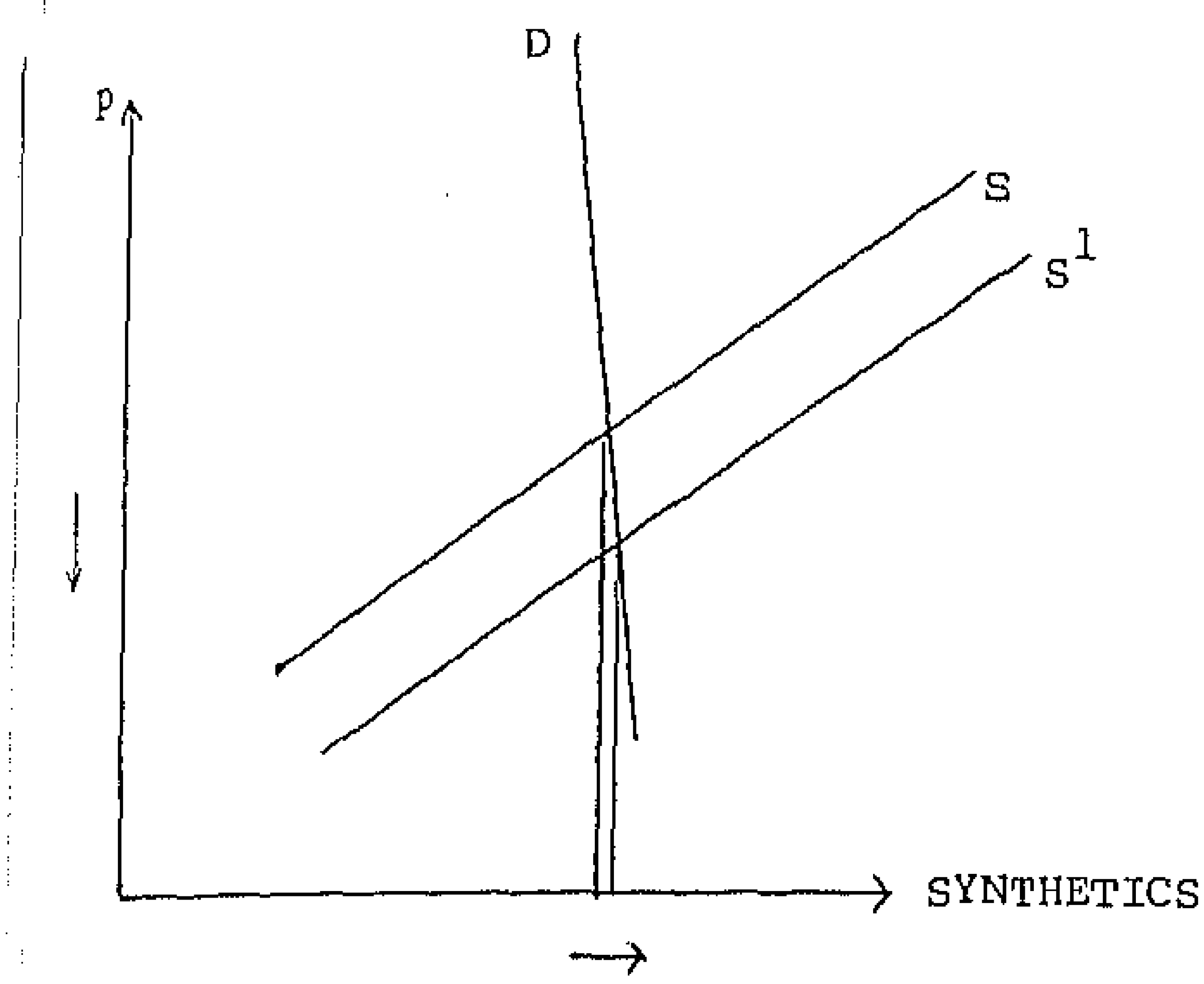


Figure - IV.1

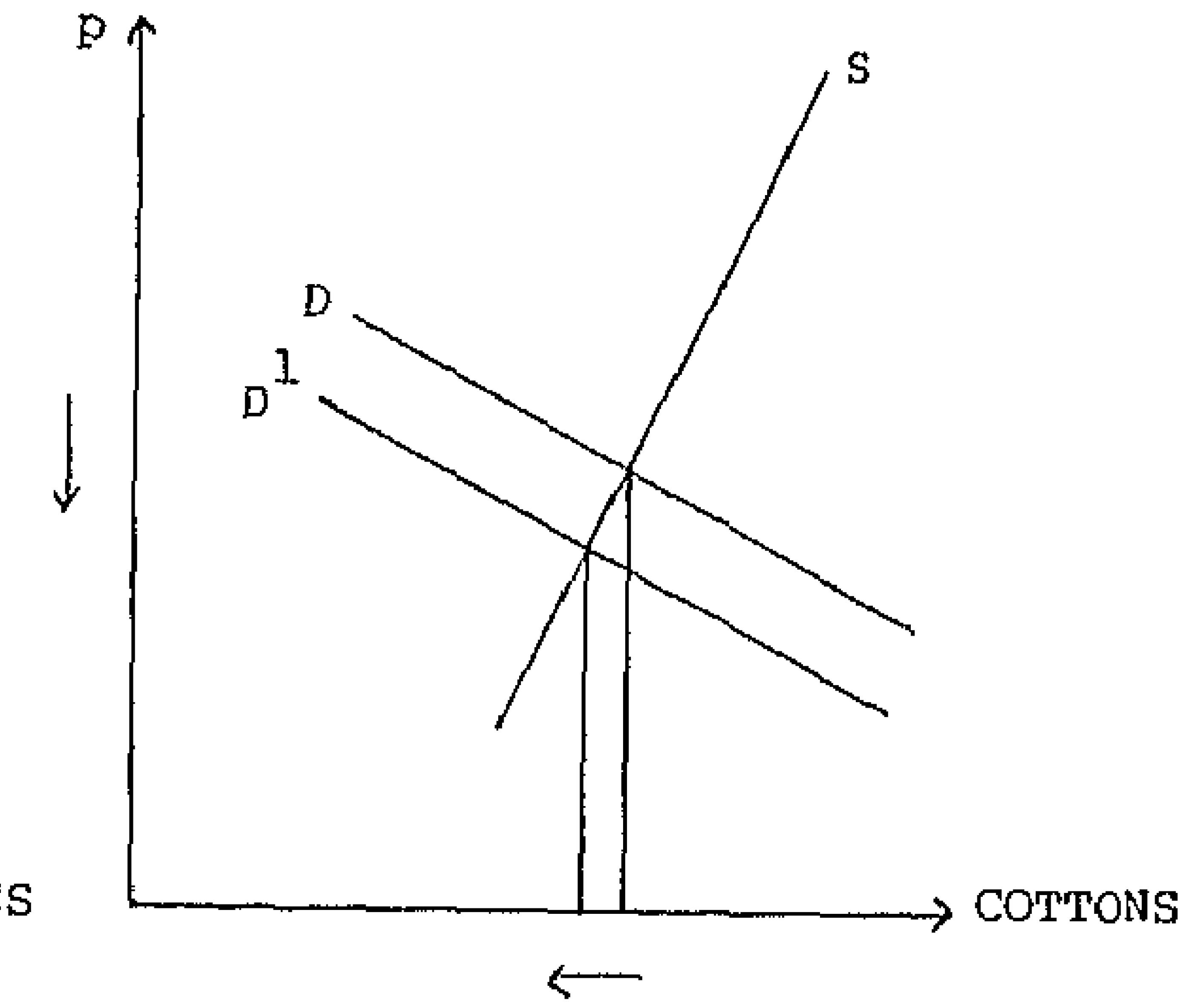


Figure IV.2

DECREASE IN TAX ON COTTONS

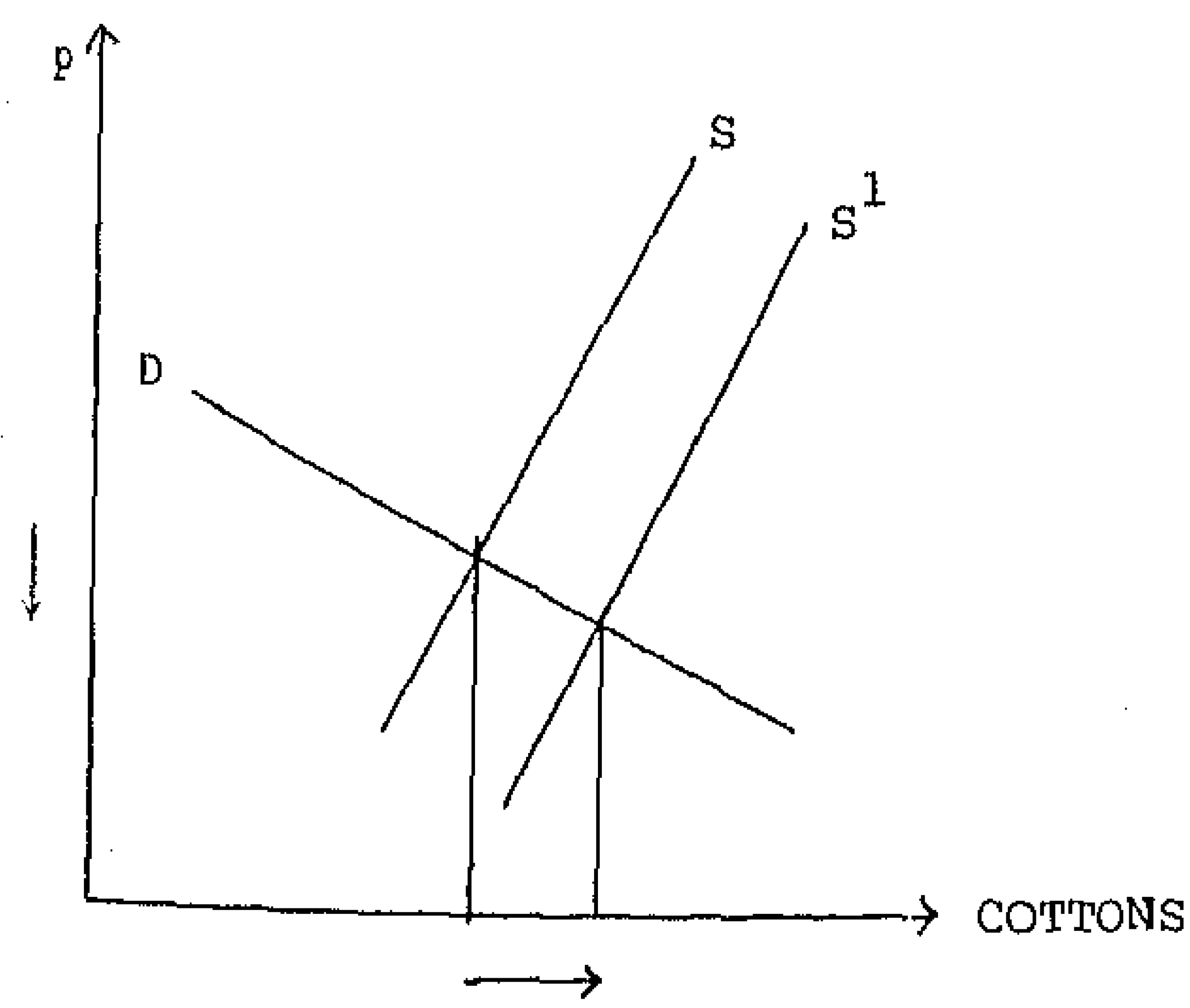


Figure IV.3

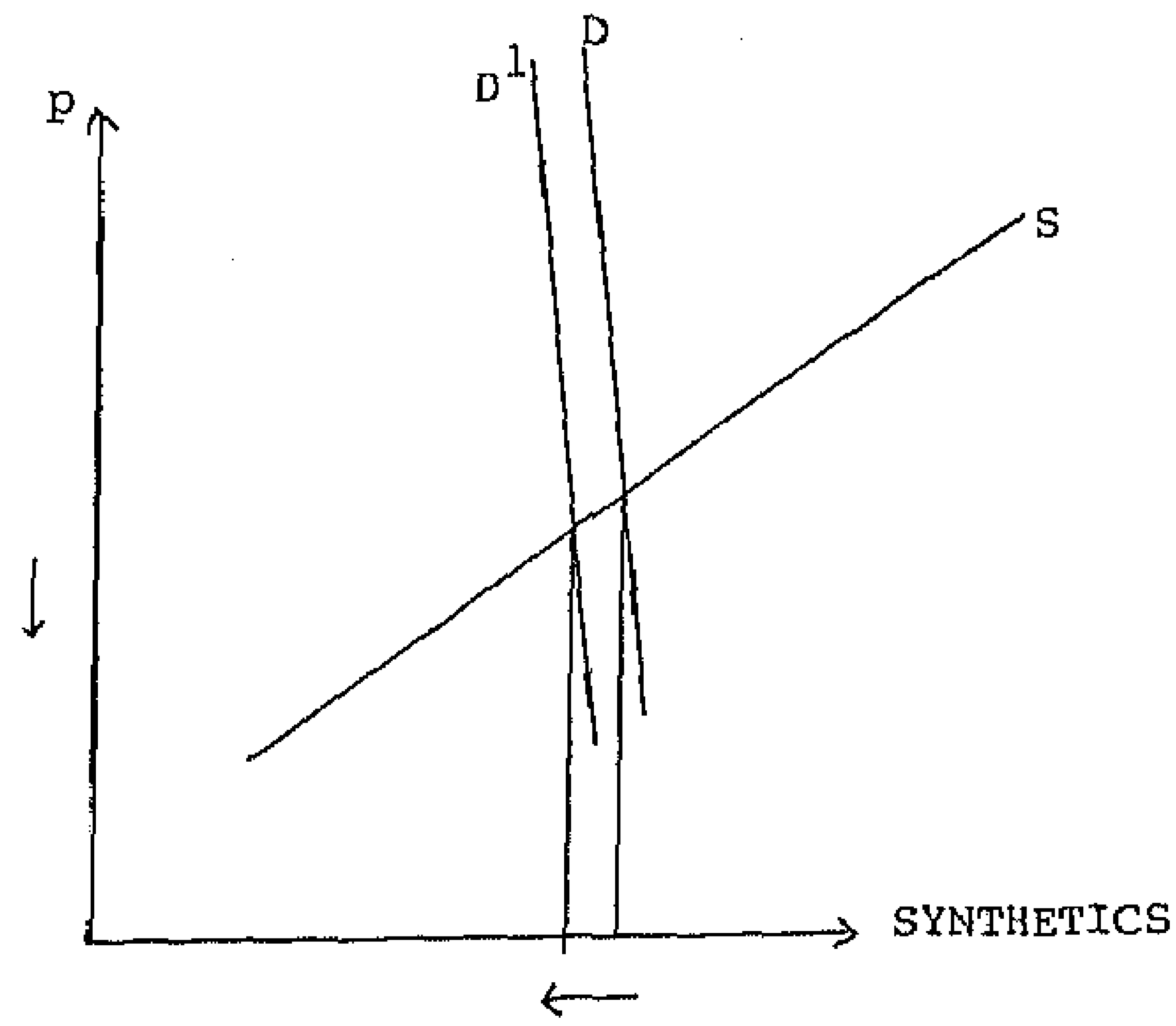


Figure - IV.4

shifts down. This leads to a fall in the output of synthetics. But, the net effect is a rise in the total cloth output.

Thus, in the case of a decrease in tax on cottons the increase in cotton output is large enough (due to elastic demand curve) to dominate the decrease in synthetics output obtained due to substitution effect. Whereas, in the case of a decrease in tax on synthetics the increase in output of synthetics is small enough (due to inelastic demand curve) to be dominated by the fall in the output of cottons caused by the substitution effect. Hence, the opposite result in the two cases.

As expected a decrease in the tax on synthetics leads to an increase in the output of synthetics and there is a reduction of inequality in the consumption of synthetics. This implies a widening of the multifibre base which is mainly a result of a decrease in the price of synthetics. But, the total cloth output decreases because of a decrease in the output of cottons. This could have an adverse impact on the producers of cotton cloth such as the handloom sector as well as on the producers of raw cotton. Thus, if the desired objectives are to increase the total output of cloth and to protect the cotton producers, then the government should opt for a decrease in tax on cottons and not on synthetics.

The changes in taxes produce very small changes in the income distribution(see table IV.9). With an increase in the tax on cottons the inequality in the consumption of cottons accross different income groups increases but the inequality for synthetics decreases. Prices of both cottons and synthetics go up with the increase being higher for cottons. In the case of an

Table IV.9

Effects of taxes on the distribution of income and cloth

Policy change	(Gini Ratios) Income Distribution		(Gini Ratios) Distribution of cloth			
			Cottons		Synthetics	
	Rural	Urban	Rural	Urban	Rural	Urban
1.	.30375	.28013	.00812	.10407	.19706	.26626
2.	.30376	.28014	.00718	.10080	.20151	.27299
3.	.30358	.27993	.00697	.10014	.20122	.27265
4.	.30352	.27981	.00741	.10249	.19469	.26284
No change	.30361	.27995	.00730	.10145	.19908	.26941

increase in the tax on synthetics the inequality in the consumption of synthetics increases while that of cottons decreases.

Since the changes in tax rates produce very little changes in income, the changes in the distribution of cloth can entirely be explained with the help of price elasticities. In the case of a decrease in tax on synthetics, there is a fall in the price of synthetics. Since the demand equations of the poor for synthetics are more elastic with respect to price their consumption of synthetics increases much more than that of the rich. Thus, the Gini ratio for the consumption distribution of synthetics decreases. Also, due to the decrease in the price of synthetics the consumption of cottons decreases, and more so, for the poorer income groups, their demands being more elastic. This means an increase in the Gini ratio for the consumption distribution of cottons. Similar reasoning applies for the case of a decrease in the tax on cottons. In the case of an increase in tax on synthetics, the price of synthetics goes up. This leads to a reduction in the consumption of synthetics and the reduction is higher for poorer income groups (demands being more price elastic). Thus, the Gini ratio for the consumption of synthetics increases. The consumption of cottons rises due to substitution effect and it is more so in the case of the poor. But, since the price of cottons increases, there will be a reduction in the consumption of cottons (again, more in the case of the poor). Since it is found that the Gini ratio for the consumption distribution of cottons has gone down, it seems that the substitution effect has the dominant influence. Similar explanation holds when the tax rate on cottons is increased.

Effects on Capital intensity

The overall capital intensity of the textile industry is defined as the total capital employed (in rupees lakhs) in the industry per worker employed in the industry (i.e. total capital employed divided by the total number of employees). Let L^i , K^i denote respectively the labour and capital employed in the i th sector of the textile industry. Let $a^i = K^i/Q^i$ and $b^i = L^i/Q^i$ where Q is the output of the ith sector. Then, the overall capital intensity 'g' is obtained as $g = (\sum_i a^i Q^i) / (\sum_i b^i Q^i)$. Since the capital to output and labour to output ratios for synthetics are not available for the M-sector and D-sector separately they are assumed to be the same as those for cotton. A detailed account of the capital labour ratios is given in Appendix IV.

The effects on the overall capital intensity of the textile industry due to changes in the tax rates can be stated as follows. With an increase in the tax rate there is a decrease in the overall capital intensity. This is due to the fact that an increase in the tax rates decreases output in the capital intensive M-sector and increases output in the labour intensive D-sector. The net effect is a decrease in the overall capital intensity. Overall capital intensity increases in the case of a decrease in tax rates. This is brought about by an increase in the output from the M-sector and also from the consequent decrease in the output from the D-sector.

The policy conclusions derived from the above exercises can be summed up as follows. If one considers decreasing tax rates, higher employment is achieved by a decrease in tax on cottons. Similarly, if one considers increasing taxes, higher employment is achieved through an increase in tax on synthetics. Thus, with regard to production in the mill sector, it is advisable to discourage the production of synthetics and encourage production of cottons.

VI.3 : **Implications of Public Production of Textiles**

For a developing economy the decision of choosing a particular technique of production is a very important one. It could have varying implications for the level of employment and hence for the income distribution. The present section concentrates on some of these implications in the case of the textile industry.

The government can affect the capital intensity of production in at least two possible ways. 1) Through certain tax and/or licensing policies it can affect the levels of private production in the capital intensive and the labour intensive segments of the industry. 2) Similarly, the government can choose to produce textiles in either of these segments. In this section the focus is on the second alternative.

Public production is incorporated in the model in the following mannner. The estimated supply functions for textiles are total supply functions, which include both the private production and the public production. A simulated increase in the public production is treated as an addition to the constant term of the supply equation. This is equivalent to an outward shift of the supply curve. The additional cost incurred due to the increase in production is calculated using input-output coefficients. The net loss/gain accruing to the government is channeled to the budgetary system. In the simulation exercises for this section it is assumed that the government increases its production of cloth by 579 million metres (5% of the initial equilibrium output). This increase in production can take place either in cotton cloth or synthetic cloth and in each of these cases either in the mill sector or in the decentralized sector.

Effects on Output

For each of the alternatives mentioned above it is seen that the increase in total output is only 3% approximately (see Table IV.10) although the increase in government production is 5% of the initial output. This implies that the increase in government production results in a decrease in the private production. This is mainly due to the decrease in the prices resulting from the increase in the government production. Since the demand curve shifts, due to income effect by an amount less than the increase in the public production of cloth (i.e., less than the shift in the supply curve), the equilibrium price of cloth decreases. This decrease in price reduces the private supply since the supply curve is price elastic. The lesson that can be drawn from this exercise is that when the government tries to achieve a target level of output by increasing its production, it may end up decreasing the cloth availability.

Effects on Employment

An increase in production of cloth through any of the sectors changes the composition of output in such a way that the total employment in the textile industry increases. An increase in the production of cloth - either synthetic or cotton - through the D-sector results in a greater increase in employment than in the case of M-sector. This is expected, since the D-sector is

Table IV.10

Effects on output and Employment due to Increasing Public Production of Textiles

Policy Change (Sector through which Prodn. is increased)	Changes in Output (Percent): Cottons M	Cottons D	Cottons Total	Synthetics M	Synthetics D	Synthetics Total	Total cloth	Change in prices (Percent): Cottons	Synthetics	%ΔEmployment / %Δ Deficit	Overall Capital intensity of the textile industry (Rs.lakhs/employee)
1. TSM	1.84	0.53	1.19	70.39	- 7.30	9.48	3.55	3.34	-3.79	0.142	0.1413
2. TSD	1.84	0.52	1.19	-12.10	15.35	9.46	3.53	3.38	-3.83	1.840	0.1339
3. TCM	10.65	-1.00	4.86	- 1.63	- 0.99	1.14	3.16	-2.54	-0.68	0.193	0.1317
4. TCD	- 3.42	13.31	4.85	- 1.65	- 1.01	1.14	3.15	-2.53	-0.67	2.907	0.1352
No change	-	-	-	-	-	-	-	-	-	-	0.1360

labour intensive.

Among the four different alternatives, increase in the production of cottons through the D-sector provides for the greatest increase in the employment generated for one percent change in budget deficit. One of the reasons for this could be that the cost of production of cottons in the D-sector is the least and hence the increase in the budget deficit is least in this case.

The policy conclusion that can be derived from this is that in order to increase employment generated in the industry the government should produce cloth in the decentralized sector and it should produce cottons rather than synthetics.

Effects on the Overall Capital Intensity

With regard to the effects on the overall capital intensity of the textile industry, one can see that (Table VI.10) in the case of synthetics, as expected, an increase in production through the mill sector increases the capital intensity whereas an increase in production through the decentralized sector decreases capital intensity. An increase in the production of synthetics causes a greater change in capital intensity than that caused by an increase in the production of cottons. Since the capital to output and the labour to output ratios are assumed to be the same for both cotton and synthetic cloth, this result can only be explained by the changes in the production levels in the different sectors of the industry.

Effects on Prices and Distribution of Cloth

The percentage decrease in the price of synthetics due to an increase in the production of synthetics is greater than the decrease in the price of cottons when the production of cottons is increased. This is a reflection of the fact that the demand for synthetics is less elastic with respect to changes in own price (see section IV.5 for the estimates of elasticities). This is why the own price has to be lowered much more in the case of synthetics in order to induce an additional demand equal to the increase in production.

When the production of synthetics is increased the inequality in the consumption of cottons goes up (see Table IV.11) while that of synthetics goes down. Similarly, in the case of increasing public production of cottons the inequality in the consumption of cottons decreases and the inequality in the consumption of synthetics increases. This can be explained easily with the help of the price elasticities of demand, since there is not an appreciable change in income. An increase in the production of cottons decreases the price of cottons and since the cottons demand equations of the poorer income groups are more price elastic, the consumption of cottons by the poorer income groups increases much more than that of the richer income groups. Hence, the decrease in the Gini ratio for the consumption distribution of cottons. Because of the decrease in the price of cottons the demand for synthetics decreases due to substitution effect. Once again the demand equations of the poor for synthetics being more elastic with respect to cross price (cotton price), the Gini ratio for the consumption distribution of synthetics is increased. Similar explanation holds good for the case of increase in the production of synthetics.

Table IV.11

Distributional effects of increasing public production

Policy change	(Gini Ratios) Income distribution		(Gini Ratios) Distribution of cloth			
			Cottons		Synthetics	
	Rural	Urban	Rural	Urban	Rural	Urban
1.	.30815	.28392	.01458	.11150	.19603	.26190
2.	.30848	.28351	.01486	.11112	.19624	.26154
3.	.30484	.28063	.00547	.10059	.20355	.27528
4.	.30493	.28052	.00655	.10049	.20361	.27518
No change	.30361	.27995	.00730	.10145	.19908	.26941

IV.4: Impact of changes in Foodgrain prices on the demand for Textiles

In the existing literature (for example, Sastry (1984)) two factors are mainly held responsible for the decline or stagnancy in the consumption of textiles. These are 1) the rise in food prices and 2) the slow growth of agriculture. In developing countries like India, where a large fraction of the population is poor and a great proportion of their incomes is spent on food, changes in food prices affect the real income and hence will have considerable impact on their expenditures on other goods.

In this section, it is examined as to what extent the consumption of textiles gets affected due to changing foodgrain output and prices. In these simulation exercises the changes in foodgrain prices are brought about by the changes in foodgrain output which are obtained from changes in the exogenous rainfall indices. From Table IV.12 it can be noted that there is considerable change in the textile prices with changes in foodgrain prices. As the price of foodgrains increases, the price of textiles (cottons and synthetics) decreases. This result can be explained as follows. When foodgrain prices go up the real income goes down. This has a depressing effect on the demand for textiles and hence an equilibrium results with low levels of output and prices for textiles. When the price of foodgrains increases from 179.2 to 237.1 the consumption of textiles goes down from 11898.9 million meters to 11206.4. That is, a 30% increase in the price of foodgrains leads to a 6% decrease in the consumption of textiles. Dividing these percentage changes yields

Table IV.12

Effects of changes in Foodgrain Prices on the Consumption of Textiles

Sl.No.	Foodgrain Prices (1970-71=100)	Total supply of Textiles (Million-metres)	Prices of Textiles (1970-71=100)		Distributional Characteristic		Gini Ratios			
							Cotton		Synthetics	
			Cotton	Synthetic	Cotton	Synthetic	Rural	Urban	Rural	Urban
1.	237.1	11206.4	174.5	205.6	.4502	.2741	.00865	.09716	.20064	.27412
2.	223.0	11322.6	178.0	206.4	.4481	.2801	.00872	.09846	.19931	.27120
3.	210.2	11441.4	181.6	207.4	.4437	.2863	.00875	.09987	.19810	.26844
4.	198.4	11583.2	185.8	208.5	.4350	.2912	.00894	.10139	.19684	.26539
5.	188.6	11735.7	190.3	209.8	.4243	.3011	.00902	.10285	.19566	.26235
6.	179.2	11898.9	195.2	211.2	.4175	.3089	.00945	.10448	.19459	.25934

an elasticity figure 0.1801. Similar result has been obtained in T.N.Krishnan (1964). In this study it has been found that in the case of India, sales of mill-made cloth were inversely related both to own prices and to prices of foodgrains.

With regard to the effects on the consumption and distribution of cloth, it is seen that the inequality in the consumption of synthetic cloth is reduced for both rural and urban areas with a decrease in foodgrain price. Whereas, the inequality in the consumption of cottons is increased with a fall in price of foodgrains. This result is also evident from the distributional characteristic. These effects on the distribution of cloth are brought about due to the following reasons. There is an increase in the real income due to the fall in the foodgrain price. Also, the prices of textiles increase, the increase being higher for cottons. As noted earlier, demand for synthetics is more elastic (with respect to income, own price and cross price) for the poor. Due to a rise in income, consumption of synthetics by the poor increases much more than the increase in consumption by the rich. Consumption of synthetics will also increase due to the substitution effect caused by an increase in the price of cottons. But, due to the increase in the price of synthetics, consumption of synthetics will go down. The net effect being a decrease in the inequality in the consumption of synthetics, it can be concluded that the income and substitution effects dominate the own price effect. The increase in the inequality in the consumption of cottons is brought about by the fact that in the case of cottons, the income elasticity of demand is higher for the rich income groups.

IV.5 : Estimates of Elasticities

IV.5.1: Demand for Textiles

Aggregate demand equations have been estimated for cotton fabrics and man-made fibre fabrics using the aggregate figures on net availability for domestic consumption published in the man-made Fibre Statistics (1981). The estimates are presented below. (The period of data set is from 1965-1981).

Cotton cloth

$$S1 = 147.6 + 0.055 \log P1 + 9.57 \log P2 - 16.825 \log DY$$

(1.65) (1.83) (-3.05)

[-0.99) [0.407] [0.29]

$\bar{R}^2 = 0.73$ D.W = 1.54

Man-made Fibre Fabrics

$$\log (X2) = 4.21 + 0.745 \log (P1/PFG) - 0.718 \log (P2/PFG)$$

(1.17) (-1.87)

$$+0.507 \log (DY) + 2.39 \log (WY/DY)$$

(3.71) (3.82)

$\bar{R}^2 = 0.87$ D.W = 2.21

Where

S1 = The share of expenditure on cotton textiles in the disposable income

P1 = Price Index of cotton cloth (1970-71 = 100)

PFG = Price Index of foodgrains

P2 = Price Index of silk and synthetic fibre textiles (a proxy for the price of man-made fibre fabrics)

DY = Disposable income

WY = Wage income

( ) gives the t-values

[ ] gives the elasticities at the mean

D.W. is the Durbin Watson Statistic

It may be noted that the income elasticity of synthetic cloth is higher than that for cotton cloth and also the price elasticities of the different varieties of cloth are greater (in magnitude) than the income elasticities. The demand for cotton cloth is more price elastic than the demand for synthetic cloth.

The different estimates of demand elasticities for textiles in the recent literature are based on different data sets and different methods of estimation. Hence, it would be a messy affair to compare and discuss them. A brief survey of these estimates is found in Omkar Goswami (1985).

IV.5.2 : Supply of Textiles

There are very few studies on the supply aspects of the textile industry which contain estimates of the supply elasticities of the different varieties of cloth in the different producing sectors. (like mills powerlooms and handlooms) Production function estimates for the cotton mill industry using capital surrogates like consumption of energy and electricity are found in D.U. Sastry (1984), which also discusses the factors affecting capacity utilization. Most other studies have concentrated on the comparison of costs in the different producing sectors like powerlooms, mills and handlooms.

The factors related to the supply of textiles are very complex. The production structures and hence the cost structures are very different for the different production sectors. In order to keep the analysis tractable the supply aspects are modelled by estimating simple supply equations for the mill sector and the decentralized sector separetely. Since the aggregate data on the output of the powerlooms and handlooms are lumped together under the head of the decentralized sector, it becomes difficult to discuss the policy effects in the handloom sector and the powerloom sector separately.

The estimates of the supply equations are given below.

Cottoncloth

Mill Sector

$$\log(CTM) = 7.66 + .906 \log(PCT) - .28 \log(PCY) - .486\,(PCHM)$$

$$\qquad\qquad (2.217) \qquad\qquad (-2.49) \qquad\qquad (-1.89)$$

$\bar{R}^2 = 0.41$ D.W. = 2.54

2. Decentralized sector

$$\log(CTD) = 6.95 + 0.262 \log(PCT) - 0.0046 \log(PCY)$$

$$\qquad\qquad (1.915) \qquad\qquad (-0.023)$$

$\bar{R}^2 = 0.57$ D.W. = 1.56

Man-made fibre cloth

1. Mill sector

$$STM = -668.66 + 9.246\ PST - 1.6\ PSY$$

$$\qquad\qquad (1.23) \qquad\qquad (-1.278)$$

$$\qquad\qquad [5.826] \qquad\qquad [-1.109]$$

$\bar{R}^2 = 0.54$ D.W. = 1.51

2. Decentralized sector

$$\log(STD) = 2.096 + 1.443 \log(PST) + .0298 \log(PSY) - .42 \log(PCHM)$$

(1.59) (0.93) (-0.69)

$\bar{R}^2 = 0.54$ D.W. = 1.14

Note

[ ] contain elasticities at the mean

CTM = Cotton textiles from the mill sector

CTD = Cotton textiles from the decentralized sector

STM = Synthetic textiles from the mill sector

STD = Synthetic textiles from the decentralized sector

PCT = Price index (1970-71=100) of cotton textiles

PCY = Price index (1970-71=100) of cotton yarn

PCHM = Price index (1970-71=100) of Basic Industrial Chemicals

PSY = Price index (1970-71=100) of Synthetic yarn

PST = Price index (1970-71=100) of Synthetic textiles

From the above estimates one can see that except for the cotton cloth from the decentralized sector all other outputs are highly price elastic especially the synthetic cloth output from the mill sector. Cotton mill cloth is elastic with respect to cotton yarn's price whereas the output of cotton cloth from the decentralized sector doesn't seem to get affected by the price of cotton yarn. This could be a reflection of the government's policies towards the protection of the decentralized sector. A similar observation can be made regarding the elasticity of the output of synthetic cloth with respect to the price of synthetic yarn.

CHAPTER V

Summary of The Results

This study has dealt with some of the policy issues concerning the foodgrains sector and the textile sector of the Indian economy. An 11-sector general equilibrium model was built involving some of the distinguishing features of developing economies (rationing mechanisms, administered prices, income distribution mechanisms etc). Through simulation exercises the impact of several policy changes on the major macro economic aggregates, distribution of output and income accross income groups etc, was examined.

The findings of the study can be briefly summarized as follows.

In the case of foodgrain policies it is found that the weighted average prices (for both rice and wheat) received by the producers in the case of dual pricing are greater than the free market prices obtained in the case of uniform pricing. This shows that farmers really do not have disincentives for producing more under the procurement policies and the public distribution scheme introduced by the government. It is also seen that the consumption inequality of foodgrains is reduced due to the PDS. Thus a better distribution of foodgrains can be achieved while reinforcing the growth of foodgrain output.

The effect of PDS on various income groups shows that (in both rural and urban areas) the relatively poorer groups gain while the richer sections lose. This is a clear case of redistribution of income from the rich to the poor. It has also been observed that when not covered by PDS the poorer people are the worst affected.

Two alternatives have been considered in tackling the surplus food stocks problem in the short run : 1. distribution of foodgrains free of cost to the vulnerable sections of the population through poverty relief programmes, public works programmes etc. and 2. sale of foodgrains in the open market. In both these cases it is found that the distribution of foodgrains improves but there is a decrease in the growth rate (real GNP). This is due to the fall in foodgrain price. The fall in foodgrain price is higher in case 2 and hence the decrease in the supply of foodgrains is also higher. On the whole it is found that option 1 is better than option 2.

Some of the results obtained from the textile policy exercises are as follows:

1. With regard to tax policies, the policy simulations reveal that higher levels of employment, cloth output and a more equitable distribution of cloth can be achieved by encouraging production of cottons rather than synthetics.

2. When there is a decrease in tax on cottons the total cloth output increases whereas, the total cloth output goes down when there is decrease in tax on synthetics. This is brought about due to the differences in the elasticities of demand for

cottons and synthetics.

3. Foodgrain prices have considerable impact on the textiles sector. For example, a 30% increase in the price of foodgrains leads to a 6% decrease in the cosumption of textiles. It has also been noticed that a decrease in foodgrain price improves the distribution of synthetic cloth among both rural and urban groups though the inequality in the consumption of cottons increases.

4. With regard to public production of cloth the policy simulations also reveal that higher levels of employment can be achieved through increased production in the decentralized sector and more so through the production of cottons rather than synthetics.

5. Increased production of cloth by the government leads to a decrease in the output from private production. This suggests that when the government tries to increase the total output to a particular level by increasing its production it might end up decreasing the cloth availability.

APPENDIX I

Notations and Units

BIG : Basic and Intermediate goods (Index numbers of production with base 1970-71)

C : Construction (Rs. crores)

CD : Consumer Durables (Rs. crores at 1970-71 prices)

CHM : Basic Industrial Chemicals

CND : Consumer Non Durables (Rs. crores at 1970-71 prices)

CNDNT : Consumer Non Durables other than textiles (Rs. crores at 1970-71 prices)

CRD : Credit Demand (Rs. crores)

CRS : Credit Supply (Rs. crores)

CY : Cotton Yarn

DF : Deficit Financing (Rs. crores)

ΔDF : Change in Deficit Financing (Rs. crores)

Δcr : Variations in credit to the business sector (Rs. crores)

ΔCr G : Variations in credit to the government sector (Rs.crs)

DT : Direct tax rate

DTR : Direct tax revenue (Rs. crores)

DY : Disposable Income (Rs. crores)

EP : Total Expenditure (Household + Buisiness) (Rs. crores)

FG^S : Foodgrains (Million tonnes)

FG : Supply of foodgrains (Million tonnes)

FS : Food Stocks with the government (Millon tonnes)

GDCF : Gross Domestic Capital Formation (Rs. crores)

GDP : Gross Domestic Product (Rs. crores)

GE : Government Expenditure (Rs. crores)

GE endo : Government expenditure generated endogenously (Rs.crs)

GE exo : Government Expenditure specifiied exogenously (Rs.crs)

GR : Government Revenue (Rs. crores)

GR endo : Government Revenue generated endogenously (Rs. crs)

GR exo : Government Revenue specified exogenously (Rs crores)

H : High powered money (Rs. crores)

IAJ : Irrigated Area under Jowar (percent)

IAR : Irrigated Area under Rice (percent)

IAW : Irrigated Area under Wheat (percent)

Infr : Infrastructure (Rs. crores)

IR : Industrial Raw Materials (Index numbers of production with base 1970-71)

NML : Non Monetary Liabilities (Rs. crores)

OCr : Outstanding credit to the government and the commercial sectors (Rs. crores)

OFG : Foodgrains other than rice, wheat and Jowar (Million tonnes)

P : Overall Price Index (1970-71 = 100)

PBI : Public Investment (Rs. crores)

PBI 70 : Public Investment at 1970-71 prices (Rs.crores)

PE : Plant and Equipment (Rs.crores deflated by price index)

PRI : Public Investment (Rs. crores deflated by price index)

PQR : Procurement quantity of Rice (Million tonnes)

PQW : Procurement quantity of Wheat (Million tonnes)

P_i : Price Index for i th sector (1970-71 =100)

RIJ : Rainfall Index for Jowar

RIR : Rainfall Index for Rice

RIW : Rainfall Index for Wheat

R_{adv} : Rate of interest on advances

SE : Services (Rs. crores deflated by price index)

SPJ : Price index of the substitute crops for Jowar(1970-71=100)

SPR : Price index of the substitute crops for Rice(1970-71=100)

SPW : Price index of the substitute crops for Wheat(1970-71=100)

SY : Synthetic Yarn

TC : Cotton Textiles (Million metres)

TCD : Decentralized sector Cotton Textiles (Million metres)

TCM : Mill sector Cotton Textiles (Million metres)

TD : Time Deposits (Rs. crores)

TS : Man Made Fibre Fabrics (Synthetics) (Million metres)

TSD : Decentralized sector Man-Made Fibre Fabrics (Million mtrs)

TSM : Mill sector Man-Made Fibre Fabrics (Million metres)

WY : Wage Income (Rs. crores)

Y : GNP at market prices (Rs.crores)

APPENDIX II

Estimated Parameters For All The Sectors

Demand Equations

1. $\log(FG) = .37 - .41 \log(P_{FG}) + .54 \log(EP) - .27 \log(WY/DY)$

   (-2.49) (4.10) (-1.02)

   $\bar{R}^2 = .896$ D.W. $= 1.87$

Note:

The above equation is an aggregate demand equation. Income group wise demand equations for foodgrains were obtained using calibration techniques, with the help of the elasticities given in Table A1 below. The specification of the equation is of the form: $\log(FG) = a + b \log(P_{FG}) + c \log(DY)$.

2. $\log(IR) = 2.77 + .02 \log(\Delta cr) + .16 \log(DY)$

   (1.10) (3.70)

   $\bar{R}^2 = .88$ D.W. $= 1.85$

3. $\log(CND\ NT) = .449 - .119 \log(P_{CND}/P_{FG}) + 1.368 \log(EP/P_{FG})$

   (-1.604) (4.11)

   $\bar{R}^2 = .73$ D.W. $= 1.49$

4. $\log(CD) = -1.68 + 1.61 \log(EP/P_{CND}) - .75 \log(P_{CD}/P_{CND}) + .264 \log(GE/EP)$

   (10.3) (-1.902) (0.56)

   $\bar{R}^2 = .93$ D.W. $= 1.62$

5. $\log(C) = -1.98 - 1.26 \log(P_C) + .99 \log(WY/DY) + 1.21 \log(DY)$

   (-5.76) (4.62) (7.78)

   $\bar{R}^2 = .96$ D.W. $= 2.43$

6. $\log(PE) = -1.92 - 0.38 \log(P_{PE}) + .53 \log(P_{CND}) + .54 \log(PBI)$

(-3.06) (3.12) (5.96)

$\bar{R}^2 = .98$ D.W. = 1.12

7. $\log(BIG) = -.56 - .26 \log(P_{BIG}) + .07 \log(\Delta cr) + .55 \log(Y_{t-1})$

(-3.06) (2.1) (6.5)

$\bar{R}^2 = .98$ D.W. = 1.12

8. $\log(SE) = -2.95 - .76 \log(P_{SE}) + 1.13 \log(Y) - .25 \log(P_{FG})$

(-10.61) (14.79) (-4.65)

$\bar{R}^2 = .99$ D.W. = 2.07

9. TC : Demand equations for each of the income groups have been estimated using the elasticities given in Table A2 below by applying calibration techniques. Observations for the year 1981 were used as benchmark data. Making use of the income group wise distribution of the aggregate consumption of textiles and the available elasticities, the demand equaions (which replicate the benchmark data) were determined. The specification of the equation is as follows:

$$\log(TC) = a + b \log(P_{TC}) + c \log(P_{TS}) + d \log(P_{FG}) + e \log(DY)$$

10. TS : Equations have been obtained for each of the income groups with the same procedure as described for TC.

11. $\log(\Delta cr) = 9.8 + 4.17 \log(P) - 1.56 \log(R_{adv})$

(3.5) (-1.1)

$\bar{R}^2 = .86$ D.W. = 1.83

Table A1: Elasticities of demand for Foodgrains

Elasticities with respect to	Income groups									
	Rural					Urban				
	1	2	3	4	5	6	7	8	9	10
Price of Foodgrains (cereals)	-.920	-.784	-.545	-.205	-.327	-.894	-.730	-.357	-.147	-.178
Price of Textiles (cloth)	-.033	-.047	-.199	-.554	-.232	+.053	-.210	-.307	-.332	-.140
Income (total expenditure)	.973	.895	.767	.443	.323	.962	.748	.490	.135	.154

Source : Murty and Radhakrishna (1981)

Table A2: Demand elasticities for textiles

Income Groups	Cottons: Own Price	Cottons: Price of Synthetics	Cottons: Income	Synthetics: Own Price	Synthetics: Price of Cottons	Synthetics: Income
RURAL						
1	-1.145	0.47	0.15	-1.162	1.68	0.51
2	-1.051	0.43	0.20	-0.84	0.87	0.38
3	-0.929	0.38	0.23	-0.53	0.55	0.31
4	-0.795	0.33	0.25	-0.34	0.36	0.26
5	-1.38	0.57	0.75	-1.02	1.06	1.34
URBAN						
6	-1.25	0.52	0.18	-1.85	1.92	0.62
7	-1.13	0.47	0.22	-1.20	1.24	0.55
8	-1.04	0.43	0.25	-0.78	0.81	0.46
9	-0.86	0.35	0.27	-0.57	0.59	0.44
10	-0.85	0.35	0.52	-0.43	0.45	0.64

Contd...

Explanatory Notes

The elasticity figures in the above table have been derived from the elasticities (at the mean) obtained from the estimated aggregate demand equations as given in section IV.5. The elasticities at different points (i.e for each income group) have been calculated using data on distribution of textiles as obtained from the textile committee's data sources.

The cross price elasticity of both cottons and synthetics with respect to foodgrain prices is approximated by the figures for the elasticity of demand for foodgrain with respect to the price of textiles as given in Table A1.

Supply Equations :

1. FG : a) Rice

b) Wheat Refer to Section III.5.2

c) Jowar

d) Other Foodgrains (exogenous)

2. $\log(IR) = 3.6 + .19 \log(P_{IR}) + .03 \log(\Delta Cr)$

$(1.68) \qquad (1.37)$

$\bar{R}^2 = .744 \quad D.W. = 2.23$

3. $\log(CND\ NT) = 3.48 + .88 \log(P_{CNDNT}) + .18 \log(\Delta Cr) - .08 (P_{IR})$

$(2.74) \qquad (3.74) \qquad (-.45)$

$\bar{R}^2 = .920 \quad D.W. = 2.27$

4. $\log(CD) = -.82 + .23 \log(\Delta Cr) + 1.43 \log(P_{CD}) - .05 \log(Infr)$

$(1.71) \qquad (1.99) \qquad (-.304)$

$\bar{R}^2 = .913 \quad D.W. = 1.27$

5. $\log(C) = 1.24 + .35 \log(P_C) + .25 \log(PRI)$

$(3.45) \qquad (2.14)$

$\bar{R}^2 = .794 \quad D.W. = 1.67$

6. $\log(PE) = -1.01 + .08 \log(P_{PE}) + .72 \log(PBI) - .39 \log(P_{BIG})$

$(0.22) \qquad (8.17) \qquad (-1.39)$

$\bar{R}^2 = .980 \quad D.W. = 1.17$

7. $\log(BIG) = .6 + .22 \log(P_{BIG}) + .66 \log(GDCF)$

$(2.099) \qquad (5.201)$

$\bar{R}^2 = .954 \quad D.W. = 1.35$

8. $\log(SE) = 2.7 + .23 \log(P_{SE}) + .08 \log(\Delta Cr)$

$(2.88) \qquad (3.43)$

$\bar{R}^2 = .92 \quad D.W. = .86$

9. $\log(TCM) = 7.66 + .906 \log (P_{TC}) - .28 \log (P_{CY}) - .486 \log (P_{CHM})$

(2.217) (-2.49) (-1.89)

$\bar{R}^2 = .41$ D.W. = 2.54

$\log(TCD) = 6.95 + .262 \log (P_{TC}) - .00461 \log (P_{CY})$

(1.915) (-0.023)

$\bar{R}^2 = .57$ D.W. = 1.56

10. $TSM = -668.66 + 9.246 P_{TS} - 1.6 P_{SY}$

(1.23) (-1.278)

[5.826] [-1.109]

$\bar{R}^2 = .54$ D.W. = 1.51

[Elasticities]

$\log(TSD) = 2.096 + 1.443 \log (P_{TS}) + .0298 \log (P_{SY}) - .42 \log (P_{CHM})$

(1.59) (0.93) (-0.69)

$\bar{R}^2 = .54$ D.W. = 1.14

11. $\log(CRS) = 1.48 + .39 \log(H) + .53 \log (TD)$

(5.8) (13.0)

$\bar{R}^2 = .99$ D.W. = 1.27

Exogenously specified values in the Model*

DT	=	0.0204	
Δcr G	=	5845	(Rs. crores)
FS	=	10 Million tonnes	
GE	=	24510	(Rs. crores)
GR	=	26255	(Rs. crores)
H	=	17250	(Rs. crores)
IAJ	=	6.2%	

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* All the values relate to the year 1980-81 but for TD, which is given fo the year 1979-80.

IAR	= 43.4%	
IAW	= 72.1%	
Infr	= 9300	(Rs. crores)
NML	= 11446	(Rs. crores)
OCr	= 50731	(Rs. crores)
OFG	= 18.507 Million tonnes	
PBI 70	= 4092.9	(Rs. crores at 70-71 prices)
PQR	= 5.68 Million tonnes	
PQW	= 6.20 Million tonnes	
P_{SY}	= 176.6	(Price index base 1970-71)
P_{CY}	= 195.7	(Price index base 1970-71)
P_{CHM}	= 190.9	(Price index base 1970-71)
RIJ	= 139.0	
RIR	= 114.4	
RIW	= 154.0	
R_{adv}	= 18	
SPJ	= 176.0	
SPR	= 245.0	
SPW	= 212.2	
TD	= 32241	(Rs. crores)

APPENDIX III

Explanatory Notes on Certain Computations

1. Overall price index (P)

$$P = 0.2(P_{FG}+P_{IR}) + .071\ P_{CNDNT} + .012\ P_{CD} + .015\ (P_C+P_{PE}) + .11\ P_{BI} + 0.4\ P_{SE} + .0101\ P_{TC} + .00574\ P_{TS}$$

2. Public Investment in Current Prices

$$PBI = PBI\ 70 \times (0.7P_C + 0.3\ P_{PE})/100$$

3. Income*

GDP at current market prices

$$= 0.87\ (FG \times P_{FG}) + 1.5\ (IR \times P_{IR}) + .0046\ (CNDNT \times P_{CND})$$
$$+ .0013\ (CD \times P_{CD}) + .36\ (C \times P_C) + .16\ (PE \times P_{PE})$$
$$+ .157\ (BIG \times P_{BIG}) + (SE \times P_{SE}) + 18500^{**} + .0014\ (TC \times P_{TC})$$
$$+ .00483\ (TS \times P_{TS})$$

4. Wage Income

WY = 0.78 Value added in agriculture

= 0.60 Value added in Manufacturing sector

= 0.73 Value added in Construction

= 0.50 Value added in Services

5. Disposable Income

DY = 0.8919 x GDP x (1-DT)

where
0.8919 = (Personal Income)/(GDP at market prices)

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* The coefficients are all ratios of value added to value of output computed for all the sectors (averages over the period 1960-61 to 1980-81). The coefficients have been adjusted whenever certain quantities were in index form.

** This constant is added to make up for the public administration, Defence and other services.

6. Government's Budget Constraint

Deficit, DF = GE - GR

where GR = GR exo + GR endo

$$GR\ endo = DTR + \sum_i TR_i \quad i = CNDNT, CD, BIG, TC, TS$$

(TR is the tax revenue from the i-th sector).

GE = GE exo + GE endo

GE endo = PBI

7. Savings

Savings = DY - EP

$$\text{where } EP = \sum_x X.P_x \quad X = FG, CNDNT, CD, .80, .8SE, TS, TC$$

(Adjustments were made whenever certain variables were indices)

8. Credit Mechanisms

$$CRD = \Delta Cr + \Delta Cr\ G$$

$$CRS = f(H^+, TD^+) + NML - OCr$$

where

$$H^+ = H + \Delta DF$$

$$TD^+ = TD + .5\ Savings$$

Current year's Time Deposits is obtained by adding half of current savings to the previous year's time deposits. Since the estimated equation for CRS (= $f(H^+, TD^+)$) covers only M3 (=M1+TD), current year's NML is added to it and the outstanding credit (OCr) to the Government and commercial sector at the beginning of the current period is subtracted in order to obtain the net availability of credit, CRS for the current year. When CRD > CRS, credit to the commercial sector ΔCr is rationed. The exact amount to be rationed in order to obtain an equilibrium in the credit market is computed.

Table A3: Matrix of Value Added Coefficients

Sector	Income Groups									
	Rural					Urban				
	1	2	3	4	5	6	7	8	9	10
FG	.1203	.0638	.0603	.1980	.3401	.0006	.0011	.0010	.0015	.0060
IR	.0474	.0552	.0756	.1394	.2364	.0073	.0125	.0134	.0109	.0575
CNDNT	.0146	.0295	.0449	.0526	.0877	.0065	.0112	.0132	.0180	.1324
CD	.0039	.0070	.0105	.0123	.0205	.0068	.0117	.0211	.0388	.2119
C	.0223	.0278	.0388	.0445	.0742	.0038	.0065	.0114	.0189	.0671
PE	.0022	.0044	.0067	.0108	.0182	.0066	.0113	.0218	.0400	.2073
BIG	.0060	.0107	.0160	.0152	.0250	.0052	.0089	.0187	.0336	.1882
SE	.0527	.0722	.1026	.0564	.0889	.0107	.0183	.0284	.0475	.1622
TEXTILES	.0097	.0162	.0240	.0138	.0219	.0071	.0121	.0189	.0321	.1257

Source: J.P. Dreze (1983)

Explanatory Notes:

The above table was derived by aggregating the coefficients obtained by J.P.Dreze (1983) for a 26 commodity classification.

The value added coefficients for the M-sector and the D-sector of the textile industry are approximated by those of th PE sector and the FG sector respectively.

The commodities covered by each of the 9 sectors are indicated by their code numbers in the 89 commodity classification of the Technical Note of the Sixth Five Year Plan :

Table A4 : Sectoral Classification

Sector	Commodities covered
FG	1,2,3,4,5,
IR	8-10, 17-19
CNDNT	14,16,37,43,44
CD	38-41,49-51,61,68,69,75,77,78
C	79
PE	62-67,70-74,,76
BIG	36,42,45-48,52-60
SE	81-89
Textiles	28-35

APPENDIX IV

Data Used in Estimation*

1. Foodgrains

The figures used for the aggregate demand were obtained from the Economic Survey (Net availability of foodgrains).

The free market demand used as the dependent variable in the estimated equations for rice, wheat and jowar were derived from the figures given in the "Bulletin on Food Statistics" published by the Ministry of Agriculture, Government of India :

Free market demand = Production - Procurement - Exports + Imports

The price data used are the wholesale price indices (1970-71=100) (Source: Chandhok (1978)).

The cropwise rainfall indices were obtained from S.K.Ray (1983).

Income figures were taken from the "National Accounts Statistics"

A list of the substitutable crops is given in the table below.

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* The time series data used for estimating the equations is from the year 1960-61 to 1980-81.

Table A5 : List of Substitutable Crops

State	Name of the Crop.
1. Andhra Pradesh	(Rice, Ragi, Mesta), (jowar,Maize, Bajra)(Cotton, Groundnut, Sesamum)
2. Bihar	(Ragi, Rice, Jute),(Wheat, Barley, Peas, Gram, Sugarcane)
3. Maharashtra	(Linseed, Wheat, Gram),(Sugarcane, Wheat, Gram) (Jowar, Bajra, Maize, Cotton)
4. Orissa	(Rice, Ragi, Jute)
5. Punjab	(Wheat, Barley, Gram,Peas),(jowar, Bajra, Maize, Cotton, Sugarcane)
6. Tamil Nadu	(Rice, Ragi, Mesta),(Jowar, Maize, Bajra),(Cotton, Groundnut, Sesamum)
7. Uttar Pradesh	(Wheat, Barley, Gram, Peas),(Jowar, Bajra, Maize, Sugarcane).

Source : Indian Agriculture in Brief (1983)

2. Industrial Raw Materials

Index for non-food grains production. This category includes:

a) Total Oilseeds

b) Total Plantation crops

c) Total Fibres

d) Condiments and Spices

e) Fruits and Vegetables

f) Miscellaneous crops

Source : Report on Currency and Finance.

3. Consumer Non-Durables

a) Food Manufacturing Industries

b) Beverages

c) Tobacco Manufacturing

d) Footwear and other weaving apparel

e) Paper and Paper products

f) Printing and Publishing

g) Rubber and Rubber products

h) Chemical and Chemical Products

i) Non-Metallic minerals

j) Textiles

Source : Report on Currency and Finance

4. Consumer Durables

This includes:

a) Manufacturing of Furniture

b) Manufacturing of Metal products

c) Machinery except electrical machinery

d) Electrical Machinery and Apparatus

e) Transport equipment

f) Miscellaneous Manufacture

Source : Report on Currency and Finance

5. <u>Construction</u>

This is taken as the total Gross Domestic Capital Formation in Construction.

Price index is obtained by dividing the total GDCF in construction at current prices by the value of output at constant prices.

Source : National Accounts Statistics.

6. <u>Plant and Equipment</u>

This is total GDCF in Machinery and Equipment Price index is computed in the same way as in the construction sector.

Source : National Accounts Statistics.

7. <u>Basic and Intermediate goods</u>

Index no. of Industrial production pertaining to Basic and Intermediate Goods Industries:

Source : Report on Currency and Finance.

8. <u>Services</u>

Value added in Finance and Real estate plus value added in Transport and communication. (Sectors like Public Administration and Defence and other services are left out).

Source : National Accounts Statistics.

9. <u>Cotton Textiles</u>

Demand parameters were estimated from the Textile Committee's Panel Data.

Supply Equations for the mill sector and Decentalized sector were estimated using the production data published - in the Report on Currency and Finance.

Price Data is obtain from Chandhok(1978).

10. Synthetic Textiles

Demand parameters were estimated from Textile Committee's Panel Data.

Supply equations for the mill and Decentralised sectors were estimated from the Data Published in the Man Made Fibre Statistics.

Price Data is obtained from Chandhok(1978).

The following is the table of input-output coefficient used for the calculation of the overall capital intensity of the textile industry.

Table A6: Capital/Labour Ratios for The Textile Industry

Sector	Capital/output (Rs.Lakhs/ Rs.Lakhs)	Labour/output (employees/ Rs.Lakhs)	Capital/Labour (Rs.Lakhs/ employees)
TCM	0.3740	1.73	0.2157
TCD	0.4118	3.52	0.1167
TSM	0.3740	1.73	0.2157
TSD	0.4118	3.52	0.1167
TOTAL	0.3995	2.94	0.1360

Source : Derived from the "Annual Survey of Inustries" 1980-81

Note:

The data for synthetics are not given for the M and D sectors separetely. Hence it is assumed that the coefficients are identical for both synthetics and cottons.

REFERENCES

Adelman, I. and S. Robinson (1978): Income Distribution Policy in Developing countries: A Case Study of Korea. Stanford University Press , Stanford.

Binswanger, H.P. and Swamy, G. (1983): "Flexible Consumer Demand Systems and Linear Estimation: Food in India", American Journal Of Agricultural Economics, Vol.65, No.4, pp.675-684.

Chandhok, H.L. (1978): Whole sale Price Statistics: India, 1947-1978, Vol.I,II, Economic and Scientific Research Foundation.

Chetty, V.K. and C. Haliburn (1984): "Estimation of Price and Income Elasticities of Demand for Foodgrains in an Economy With Public Distribution Schemes", Indian Statistical Institute, Technical Report No. 8405.

Chetty, V.K and Shikha Jha (1983): "Dual pricing and Supply Behaviour: A Partial Equilibrium Analysis", Report No. 3, ICSSR research programme on Price and Distribution Controls in the Indian Economy.

Chetty, V.K. and Shikha Jha (1986): "Micro Economics of Rationing and Licensing ", Journal of Quantitative Economics, Vol. 2, No. 2 pp. 173-198.

Chopra, R.N. (1981): Evolution of Food Policy in India. Delhi: Macmillan and Co.

Dantwala, M.L. (1967): "Incentives and Disincentives in Indian Agriculture", Indian Journal of Agriculture Economics, Vol. 22 No. 2.

Dantwala, M.L. (1976): "Agricultural Policy since Independence", Indian Journal of Agricultural Economics, Vol.31, No.4

Deaton, A and Muellbauer, J. (1980): "An Almost Ideal Demand System", American Economic Review, Vol.70, No.3, pp. 132-326.

Devarajan, S. and S. Robinson (1983): Selected Bibliography on Computable General Equilibrium Models of Developing Countries, The World Bank Mimeo.

Dreze, J.P.H. (1983): On The Choice of Shadow Prices for Project Evaluation, Unpublished Ph.D. Thesis submitted to the Indian Statistical Institute, New Delhi.

Garg, V.K. (1980) : State in Foodgrain Trade in India. New Delhi. : Vision Books.

George, P.S. and James Gavan (1977) :Market Intervention in Food Distribution, Working Paper 78/5, International Food Policy Research Institute, Washington, D.C.

George, P.S. (1985) :Some Aspects of Procurement and Distribution of Foodgrains in India, Working Papers on Food Subsidies, No. 1, Washington, D.C. : International Food Policy Research Institute.

Government of India, Ministry of Supply and Textiles, Department of Textiles , Statement on Textile Policy, June 1985.

Government of India, Ministry of Agriculture and Irrigation, Directorate of Economics and Statistics, (1976) :Indian Agriculture in Brief. New Delhi : Controller of Publications.

Government of India, Economic Survey, Various issues. New Delhi. : Controller of Publications, various years.

Government of India, Perspective Planning Division, Planning Commission, A Technical Note on The Sixth Plan of India (1980-85). July 1981, New Delhi.

Government of India, Central Statistical Organisation, National Accounts Statistics, various issues, New Delhi, Controller of Publications, various years.

Government of India, Ministry of Agriculture, Directorate of Economics and Statistics, Bulletin on Food Statistics, various issues, New Delhi : Controller of Publications, various years.

Government of India, Ministry of Agriculture & Irrigation, Directorate of Economics and Statistics, Estimates of Area and Production of Principal Crops in India, Various Issues.

Government of India, Planning Commission, Draft, Seventh Five Year Plan, Vol. I,II, October 1985, New Delhi.

Government of India, Ministry of Planning, Department of Statistics, Central Statistical Organisation, Annual Survey of Industries, 1979 - 80.

Gulati, J.S. and T.N.Krishnan (1975) : "Public Distribution and Procurement of Foodgrains: A Proposal", Economic and Political Weekly, May 1975, pp. 829-842.

Hausman, J.A. (1985) : "The Econometrics of Non-linear Budget sets", Econometrica, Vol. 53, No.6, pp. 1255-1282.

Kahlon, A.S. and D.S.Tyagi (1983) : Agricultural Price Policy in India, Allied Publishers, India.

Krishna, Raj and Ajay Chhibber (1983) :Policy Modeling of a Dual Grain Market: The Case of Wheat in India, Research Report No. 38, Washington, D.C. : International Food Policy Research Institute.

Krishna, Raj and G.S.Raychaudhuri (1980) : Some Aspects of Wheat and Rice Price Policy in India, World Bank Staff Working paper No. 381, Washington, D.C. : International Bank for Reconstruction and Development.

Krishnan, T.N. (1964) : The Role of Agriculture in Economic Development, Ph.D. Thesis, Massachusetts Institute of Technology, Cambridge, Mass.

Kurian, N.J. (1986) : "Economics of Rice Production in India: Interregional and Intertemporal Analysis", Journal Of Quantitative Economics, Vol. 2, No. 1, pp. 51-76.

Lysy, F. and L.Taylor (1980) : "The General Equilibrium Income Distribution Model", in Models of Growth and Distribution for Brazil, Oxford University Press, Oxford.

Man Made Fibre Statistics (1981) , Published by the Association of Man Made Fibre Industry : Bombay, India.

Mansur, A. and John Whalley (1983) : "Numerical Specification of Applied General Equilibrium: Estimation Calibration and Data", in Applied General Equilibrium Analysis, Edited by H.Scarf and J.B.Shoven. NewYork : Cambridge University Press.

Mellor, John W. (1975) : Agricultural Price Policy and Income Distribution in Low Income Nations, World Bank Staff Working Paper No. 214, Washington, D.C. International Bank for Reconstruction and Development.

Murty, K.N. and R.Radhakrishna (1981) : "Agricultural Prices, Income Distribution and Demand Patterns in a Low Income Country", Discussion paper presented at the Symposium on Economic Theory and Planning, Indian Statistical Institute, Bangalore, December.

Narayana, N.S.S. and K.S.Parikh (1981) : "Estimation of Farm Supply Response and Acreage Allocation: A Case Study of Indian Agriculture", RR-81-1, Laxenburg, Austria : International Institute for Applied Systems Analysis.

National Sample Survey Organisation, Consumer Expenditure Survey (28th Round), October 1973 - June 1974, NewDelhi.

Neary, J.P. and K.W.S.Roberts (1980) "The Theory of Household

Behaviour under Rationing", European Economic Review, Vol. 13, No. pp. 25-42.

Omkar Goswami (1985) : "Indian Textile Industry, 1970-84: An Analysis of Demand and Supply", Economic and Political Weekly, Vol. 20, No. 38, September 21,1985, pp. 1603-1614.

Parikh, K.S. and N.S.S.Narayana (1981) : "An Agricultural Policy Model for India - An Illustrative Exploration of a Right-To-Food Program", in Food for All in a Sustainable World. Edited by Kirit Parikh and Ferenc Rabar. SR-81-2, Laxenburg, Austria: International Institute for Applied Systems.

Ray, S.K. (1983) : "Growth and Instability in Indian Agriculture", Mimeo , Institute of Economic Growth, University of Delhi.

Sastry, D.U. (1984) : The Cotton Mill Industry in India, Oxford University Press, Delhi.

Shoven, J. and John Whalley (1984) : "Applied General Equilibrium Models of Taxation and International Trade", Journal of Economic Literature, Vol. XXII, pp. 1007-1051.

Sinha, R., P.Pearson, G.Kadekodi and M.Gregory (1979) : Income Distribution, Growth and Basic Needs in India, Vikas, New Delhi.

Subbarao, K. (1977) : 'Market Structure in Indian Agriculture, A Study of Economic Efficiency of Paddy/Rice Marketing System in West Godavari District", Ph.D. Dissertation University of Delhi.

Sukumary Murty (1983) : "An Approach To Estimate Demand Models for Clothing In India", Anveshak, SardarPatel Institute, Ahmedabad, India.

Tarrant, John R. (1980) : Food Policies NewYork : John Wiley and Sons.

Vyas, V.S. and Bandopadhyay (1975) : "National food Policy in The Framework of a National Food budget", Economic and Political Weekly, March 1975, pp. 112-118.

Wall John (1978) : Foodgrain Management: Pricing, Procurement, Distribution, Import and Storage Policy in India, World Bank Staff Working Paper No.279, Washington D.C.