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CONTENTS

Chapter 1

INTRODUCTION

In developing economies, the per capita availability of essential goods and services is quite low. Hence a large section of the society cannot afford even the minimum necessities of life. While human and natural resources are plenty, produced means of production like plant and equipment and construction materials are scarce. Hence the human resources are not fully utilized. Since the distribution of income and assets is highly skewed, even the small quantity of essential goods and services is not equitably distributed. When resources like land and capital are privately owned and goods and services are distributed through the market mechanism, the pattern of production is heavily influenced by the prevailing distribution of income and wealth. Resources are devoted to the production of luxury goods. Under the circumstances, the governments in developing countries play a dominant role to promote growth and equity.

The manner in which a government can intervene depends upon the social, political and economic organization of the country. Major policy instruments are taxes, subsidies, rationing and licensing. In addition, the government may also directly participate in production activities. When the number of policy instruments is large, the policy maker faces the difficulty of choosing the most effective ones. In theory one policy may be superior to another for achieving a target; but in practice it may fail. Or a policy which is effective in one region of a country may fail in another region. It is easy, for instance, to argue that cooperative organizations in production are superior to non-cooperative organizations. Take the example of Indian sugar cooperatives, in which cane growers form a cooperative and contribute fully to the equity capital of a sugar factory. They have been extremely successful in Maharashtra, Gujarat and western Uttar Pradesh (in terms of yield of sugarcane per hectare and the recovery rate), but similar organizations have totally failed in Bihar and eastern Uttar Pradesh. Another example at hand is the controversy regarding physical and financial controls. Some economists argue that physical controls like licensing are not effective. Again, if we look at the Indian experience in sugar and cement industries, every plan target has been achieved in the case of sugar, while it has not been achieved even for a single year in the case of cement, until physical control was partly relaxed a few years ago. Thus, for planned economic development, the need for a framework incorporating the many policy instruments and economic institutions is overwhelming. The purpose of this study is to develop one such framework.

A typical planning model in the existing literature - for example, the Indian plan model - sets about its its work in the following fashion[1]. The objective is to attain a target rate of growth of national income and a reduction in inequality. Assuming the base year relative prices to remain invariant, the sectoral private demand for various goods and services are worked out using some given income

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[1] For literature on planning models, see Rudra (1975), Gupta (1986) and Government of India (1981).

elasticities. (Sometimes, to preserve the real content of resource requirement, an 'accounting' rate of inflation is assumed.) The government demand for goods and services are taken to be exogenous. The vector of total final demand is obtained as the sum of private and government demand. The technology, as represented by an extended Leontief matrix, is assumed to remain constant over the plan period. The Leontief inverse is applied to the final demand vector to obtain a consistent set of gross outputs. The investment requirement by each sector is then worked out using a capital coefficients matrix. More often than not the investment requirement would exceed the funds available to the planners at existing tax rates and producer prices, in which case measures are undertaken to raise additional resources. It is important to note here that in a mixed economy, while the government finances its investment through such measures as taxation and market borrowing, or at the worst, by printing money (borrowing from the central bank), the target level of private investment is achieved more through a scheme of incentives and disincentives ('indicative planning') than by direct interference.

Such a model suffers from at least two inherent inconsistencies:

1. The assumption that relative prices remain unchanged is crucial to the consistency of the model. But the very act of raising resources for the public sector, e.g., indirect taxation, would immediately alter the relative prices.

2. Since such a model is usually the 'open loop' type where generation and distribution of income are not explicitly linked to the production processes, income distribution, which most of the

developing countries would like to affect on equity grounds, is not properly treated. In the Indian (Fifth) Plan Model, for example, a minimum needs programme, designed to ensure a minimum consumption basket for the poorer sections of the populace, was appended to the main body of the plan through a scheme of direct income transfers rather than a suitable change in the output mix. Given the structure of such models, the initial income distribution that is implicit in the final demand vector to start with may not match the one implied by the gross output vector obtained subsequently.

To be free from these inconsistencies a plan model has to adopt a simultaneous solutions method whereby relative prices are determined endogenously, with income generation and distribution taking place through the production process itself. The currently popular applied or computable general equilibrium (CGE) models overcome these inconsistencies remarkably well.

A CGE model, e.g., Shoven and Whalley (1984), is typically a multi-sector-multi-agent model, based on strong microeconomic foundations[2]. Starting with a vector of factor endowments and a set of factor prices, supply of products is obtained when producers maximize profit subject to a Cobb-Douglas or CES production function. Demand for products is similarly obtained when each consumer maximizes utility subject to the budget constraint. (The utility function is

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[2] Besides Shoven and Whalley (1984), Dervis *et al* (1982), Scarf and Shoven ed. (1984) and Piggot and Whalley ed. (1985) contain an extensive discussion on CGE models. Ginsburgh and Waelbroeck (1984) attempt to draw an interesting analogy between a typical planning model of 1960s and the CGE models.

commonly a CES function, though sometimes linear expenditure system is also being used.) Aggregate demand is obtained as the sum of individual demands. Since the production functions exhibit constant returns to scale, the prices that equilibrate demand and supply in the products market can be expressed as a function of the factor prices (using the non-substitution theorem of Samuelson (1951)). The demand for factors consistent with the demand for (and supply of) products is computed. Demand and supply in the factor markets are now compared. If there is excess demand (supply), factor prices are revised upward (downward) and the model is solved again. The process is continued till the factor markets clear.

However, a typical CGE model may not be quite appropriate for our purpose. First, since it is based in a Walrasian set up of complete price flexibility, it cannot accommodate price and wage rigidities entailed by various institutional arrangements such as administered prices, automatic wage indexation, minimum wage legislation etc. It will be more realistic to adopt a non-Walrasian framework[3].

From an empirical point of view, an important weakness of CGE models is their disregard for statistical reliability while specifying parameters. Most of these models adopt deterministic 'calibration'

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[3] An attempt in this direction has been made by Nguyen (1985). However, he makes the extreme assumption that *all* prices are fixed by a government decree. The model by Narayana et al. (1987) can also be called non-Walrasian since their (estimated target) prices are realized through adjustments in trade quotas or domestic stocks. Their assumption is that the government *steers* all domestic prices towards world market prices. It is, however, more realistic to have a suitable combination of fixed, sticky and partly flexible prices. See also Nayak (1980), Benassy (1982) and Lambert (1988).

procedures rather than economic estimation[4]. The reasons are that the number of parameters in an economy wide model is usually very large, and simultaneously estimating all paremeters, while adhering to basic economic identities such as Walras' law, would require unrealistically large numbers of observations or overly severe identifying restrictions[5]. Calibration, on the other hand, requires data for only one year (or a few years, depending on the type of model), and allows the model to incorporate all important economic identities. But calibration has its own disadvantages. It requires highly restrictive assumptions on technology and preferences. For example, calibration may not be very meaningful when agents (e.g., public enterprises in India) do not operate on profit motives. It is certainly desirable to have economically meaningful *and* statistically significant parameters[6].

A glaring omission from most economywide models is the financial market. Almost all models assume that money does not matter except in an accounting sense. Endogenisation of money is avoided largely because of the serious conceptual problems it raises in the context of general equilibrium models.

[4] Calibration technique is discussed at length in Shoven and Whalley (1984, pp 1016-1021), Mansur and Whalley (1984) and Whalley (1985).

[5] Most of the macroeconometric models on India (for example, Krishnamurty et al. (1989), Bhattacharya (1986), Ghosh et al. (1983), Pani (1979)) suffer from this shortcoming. Basic identities such as Walras' law are often not adhered to, because parameters are usually estimated taking single equations. Also there is a tendency to simplify the structure of the economic model to allow for substantial richness in statistical specification.

[6] Some beginning has been made in this direction by Jorgenson (1984) and Jorgenson and Slesnick (1985).

One of the major issues is whether equilibrium (i.e., demand-supply equality) would exist at all in a Walrasian flex-price system with money. The controversy started with Keynes' (1936) claim that a fully competitive economy could well get trapped into a disequilibrium situation. Pigou (1943), Patinkin (1965), Friedman (1956, 1969) and Johnson (1967) among others argued that Keynes overlooked an important class of regulating mechanism, namely, the real balance or wealth effects, which would ensure market clearance in the presence of flexible prices. Keynesians however would argue that real balance effects are too weak to guarantee equilibrium (Tobin 1980). The new classical macroeconomists' believe that markets do clear at every instant, but go on to add that money does not matter in the working of a real economy. Grandmont (1983) proves the existence of short run Walrasian equilibrium by using another class of regulating mechanism, the intertemporal substitution effects, but arrives at a broadly Keyenesian conclusion that existence of monetary equilibrium requires highly unrealistic restrictions on traders' expectations about future prices and interest rates. In the long run, however, money is non-neutral according to him.

The treatment of money even in an accounting sense would require its supply to be determined endogenously, if there are rigidities in prices and interest rates. Money supply in a broad sense consists of two components: (i) the high powered money issued by the government (or the central bank) and (ii) the credit created by the commercial banks. When the interest rate is set exogenously (as it is in most developing countries like India), only the *notional* supply of money is exogenous[7] The observed or *actual* supply of money is however the short side of the market: it equals the notional supply only when the notional demand for credit exceeds the notional or maximum credit that can be extended. Actual money supply can be regarded as exogenously given only when bank credit is rationed. Otherwise it will be endogenous. Under such circumstances, it will not be surprising if the endogenously determined money supply and the same implied by the 'accounting inflation' in the plan models do not match. The empirical evidence that the actual inflation was never the same as the accounting inflation assumed in the Indian plans, for example, could be attributed partly to such a discrepancy.

While the role of financial intermediation in production is indisputable, it is now well established that money will be non-neutral, at least in the short run, even in a Walrasian exchange economy. In the presence of price rigidities, or when its distribution among individuals varies with changes in its supply, money will generally be non-neutral (Grandmont (1983, pp 38-45, 151)). It is desirable, therefore, to endogenise money in the model in a way that

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[7] The notional supply of money is equal to the sum of exogenously set quantity of high powered money and the *maximum* credit that can be extended, given an exogenously specified reserve ratio. The *actual* money supply is similarly the sum of high powered money and the *actual* bank credit.

it matters[8].

The plan of this study is as follows:

In Chapter 2, we develop a computable general equilibrium model of India extended to a non-Walrasian framework with an integrated financial market. The non-Walrasian set up allows us to introduce administered and dual prices for publicly produced and distributed goods. The role of bank credit in business is highlighted in the model. Most of the parameters of the model are econometrically estimated, but at the same time Walras' law is ensured. The model is set in a static frame.

Chapter 3 and 4 are addressed to two important aspects of resource mobilisation in the Indian context. In Chapter 3, the implications of raising resources through an upward revision of public sector (administered) prices are examined under different scenarios. Chapter 4 explores the possibility of saving some resources by curtailing the volume of food subsidy, which is a considerable burden on the exchequer currently. The selection of these two problems was guided by their topicality in the context of the severe resource crunch being faced by the Indian planners today.

In Chapter 5, the static model of Chapter 2 is extended to a dynamic model (to be called a planning model) by introducing the time element and establishing the link between investment and output. A plan is assumed to consist of five periods, to conform with the Indian

[8] Feltenstein (1984) does this by treating supply of money and bonds as a means of financing public investment, and demand for them as arising out of consumers' needs to meet transaction costs. It will be interesting to make explicit the role of credit in private production as well, by introducing a private banking sector besides the central bank.

Five Year Plans. Under each scenario, the model is run for five periods. The model is applied to a number of questions regarding the effectiveness of various policy instruments of the government. A plausible scheme (policy package) is worked out to yield a maximal and most equitable rate of growth of national income.

Chapter 6 contains summary of results and concluding remarks.

Chapter 2

A GENERAL EQUILIBRIUM MODEL FOR INDIA

The need for constructing a new planning model for developing economies has been highlighted in the preceding chapter. In this chapter, we describe an 18 sector non-Walrasian computable general equilibrium model as a precursor to a dynamic plan model.

The plan of this chapter is as follows: We describe the model in the following section. We discuss the non-neutrality of money in Section 3 and describe the working of the model in Section 4. We then conclude in Section 5 with a few remarks.

2. The Model

The economy is represented by 17 commodity sectors, one financial sector and three groups of agents - household, business and government. Implicit in the model are a central bank and a private banking sector which create currency ('external' money) and credit ('internal' money) respectively.

2.1 The Commodity Markets

Commodities are grouped under three blocks in the following fashion (see Appendix I for details of sectorization):

I. Final goods block

1. Foodgrains (FG)
2. Consumer non-durables, non-textiles (CNDNT)
3. Consumer durables (CD)

4. Services (SE)

5. Cotton textiles (TC)

6. Synthetic textiles (TS)

II. Administered goods block

7. Iron and steel, ferro-alloys (ISFA)

8. Iron and steel, casting and forging (ISCF)

9. Coal and lignite (COAL)

10. Crude petroleum and natural gas (PETROL)

11. Electricity (POWER)

12. Fertilizer and pesticides (FERT)

13. Cement (CEMENT)

14. Industrial raw materials (IR)

15. Other basic and intermediate goods (BIG)

III. Investment goods block

16. Construction (C)

17. Plant and equipment (PE)

The final goods are used mainly for final consumption purposes. (They are also used for intermediate purposes - we call them 'final goods' only for convenience.) These goods are produced by private producers. Supply of foodgrains is assumed to be exogenously given reflecting its dependence on weather. Supply of other final goods are estimated as a function of own price, input price(s) and the volume of credit available to private sector[1]. The estimated equations are

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[1] While estimating supply equations, the rate of interest was also tried as an independent variable. The coefficients obtained were not significant for reasons mentioned below.

presented in Appendix II[2]. Note that prices enter the supply equations without lags, suggesting instantaneous price response of output. However, supplies are bounded above by the availability of publicly produced intermediate goods, since we postulate fixed coefficient input-output relation between final and administered goods. Thus,

$$S_f = S_f(p, CRP) \quad \text{s.t.} \quad D_\alpha \le S_\alpha \qquad (1)$$

where S stands for supply, D for demand, p producer prices, CRP bank credit to private sector and subscripts f and α indicate final and administered goods respectively.

Demand for final goods other than textiles are estimated as functions of own price, prices of substitutes and disposable income of the household[3]. In some equations, income distribution, as reflected by the share of wage income in total disposable income, is also found to be significant. For textiles, we have taken income group specific demand functions from Chetty et al. (1986)[4]. Demand for textiles is calibrated as a function of own price, prices of substitutes and

[2] All estimated equations are presented in Appendix II. Appendix I contains information on sectorization and data.

[3] We have introduced a dual pricing scheme for foodgrains so that a certain quantity of output is sold through the public distribution network at a lower price. The rest is available for sale in the open market under competitive conditions. While estimating the demand function for foodgrains, we have followed Chetty and Jha (1986) where it is shown that the demand function for a commodity under dual pricing can be estimated using a weighted average of the ration price and the free market price, and income including the ration subsidy.

[4] Ideally income group specific demand functions should be used for all commodities. Since this was difficult due to lack of data, we have tried to capture the income distribution effects on demand by introducing the share of wage income in disposable income in some equations. In the dynamic version of the model, we were able to replace the aggregate demand equation for foodgrains by calibrated income group specific demand functions.

income[5]. The demand functions for final goods, thus, can be summarized as:

$$D_f = D_f(q, DY) \quad (2)$$

where $q = p(1+\tau)$ is market price, τ indirect (excise) tax and DY disposable income of the household sector.

Administered goods are essentially intermediate goods produced in the public sector[6]. Their prices are administered according to a cost-plus rule. Since the public sector in India does not operate on profit motive, supplies of these goods are not responsive to prices and are determined by primarily technological conditions. We assume that these sectors are capacity-constrained so that their production capacities are given and being fully utilized. Their supplies,

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5 The calibration technique here is somewhat different from the usual (Shoven and Whalley, 1984, p 1018). Each demand function is of the form:

$$\log(D) = a - b \log(q) + c \log(q') + d \log(DY)$$

where q is own price, q' is price of substitute and DY disposable income of a particular income group. Using actual data on D, q, q' and DY and taking b, c and d from Murty and Radhakrishna (1981), we have worked out the intercept term a.

6 This block covers most of the items mentioned in the white paper on administered prices (Government of India 1986) as 'core', 'other fully administered' and 'partially administered' items.

therefore, are exogenously given[7]:

$$S_a = \bar{S}_a \tag{3}$$

For each administered good, final consumption demand is obtained as a fixed fraction of supply and intermediate demand is derived using an input-output table. Thus, the gross demand is,

$$D_a = CS_a + AS \tag{4}$$

where D_a and S_a are 9x1 matrix of demand for and supply of administered goods, C is 9x9 diagonal matrix of final consumption coefficients, A 9x17 matrix of input-output coefficients and S 17x1 vector of supplies of final, administered and capital goods.

Capital goods are supplied by public as well as private sectors. While supply by public sector (i.e., public investment in real terms) is assumed to be exogenously given, that by the private sector is price responsive. We have estimated the supply and demand for construction and machinery and equipment as functions of their implicit prices, input prices, public investment in nominal terms and income.

Ideally, demand for capital goods should be derived from the

[7] Since we have assumed fixed coefficient technology in these sectors, the implicit assumption here is that capital stock in the public sector is fixed and sector specific. Such assumption is quite common in the CGE literature pertaining to developing countries (e.g., Dervis et al. 1982, Devarajan and Offerdal 1989, McMahon 1989). A justification could be that capital markets in developing economies are not well developed and hence the assumption that capital flows to equalize its rate of return across sectors is difficult to corroborate. Again, since the public sector in India does not operate on profit motives, there is no tendency to shift capital to more profitable sectors. In Chapter 5, we will relax this assumption and make supply of administered goods endogenous by linking up investment and output.

production conditions (i.e. technology as reflected in production functions and behaviour of producers) prevailing in other sectors. But we use econometrically estimated demand equations. The relation between capital goods and other sectors, thus, remains implicit in our case[8].

It is clear from above that the private sector invests in final goods and a part of capital goods, while public investment is allocated among the remaining part of capital goods and the administered goods. (A justification for this assumption can be found in Government of India (1986, pp 9-11).)

Note that the dependent variable in each of these supply equations is a 'flow' variable, representing gross capital formation by assets. The demand for construction and plant and equipment together represent the total demand for investment, and when they equal the corresponding supply through adjustment in prices, they represent the total realized investment in the economy. Total investment (GDCF) is thus obtained as,

$$GDCF = S_c(.)p_c + S_{pe}(.)p_{pe} \qquad (5)$$

where S_c and S_{pe} denote supply of construction and plant and equipment respectively.

Since public investment is exogenously given, private investment (PRI) is obtained as,

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[8] The task would have been easier if there were a capital coefficients matrix. Such a matrix is yet to be available in India because of inadequacy of data on fixed capital stocks by industry of use. It is also difficult to calibrate Cobb-Douglas or CES production functions without making drastic adjustments in the official data.

$$PRI = GDCF - PBI \qquad (6)$$

where PBI denotes nominal public investment.

The equations are estimated using ordinary least squares in double-log form, for the period 1960-61 to 1980-81. It is evident that all coefficients are economically meaningful, although some are statistically not significant. We gave more emphasis to economic meaningfulness in keeping with the CGE literature[9].

It may be noted here that the demand functions are not homogeneous of degree zero in prices and nominal income. We shall discuss this point in section 3.

2.2 The Financial Market

The financial sector comprises two assets - money and bank credit. Money is created by the central bank to meet the deficit in the government budget.

Supply of bank credit, because of administered interest rates,depends upon banks' currency holdings subject to statutory conditions such as the cash-reserve ratio. Banks' currency holdings in turn depends upon the volume of new currency and saving habits of the people. We therefore estimate the following equation:

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[9] This point is rather hard to justify, although it is a fairly common practice in the CGE literature (Shoven and Whalley 1984, p 1020). In the absence of relevant (alternative) time series data and also relevant elasticities in the existing literature, we preferred statistical OLS estimates, though not significant, to guestimates. OLS is admittedly not the best method and simultaneous estimation techniques may be better. That is an area of our future research.

$$S_{CREDIT} = f(DEFICIT, FINSAV) \quad (7)$$

where DEFICIT is government budget deficit and FINSAV, savings of household sector on financial assets[10].

Bank credit is demanded by both government and private sectors. In India, banks do not make consumption loans, so the only private demand for credit is for financing investment[11]. Thus,

$$D_{CREDIT} = CRG + CRP \quad (8)$$

where CRG is government demand and CRP, business demand for credit. CRG and CRP are obtained as follows:

$$CRG = \delta PBI, \quad 0 < \delta < 1 \quad (9)$$

$$CRP = PRI - PHYSAV - BONDS \quad (10)$$

$$FINSAV = s_f SAV, \quad 0 < s_f < 1 \quad (11)$$

$$PHYSAV = (1-s_f) SAV \quad (12)$$

PHYSAV is household savings in physical assets, while BONDS are

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[10] Interest rates are administered in India. Since there is a complex rate structure, it is difficult to choose one particular rate as a representative one. Moreover, although there are occasional jumps in the administered interest rates, the variability from year to year is low (for example, scheduled commercial bank demand loan rate jumped from 8.5-12.0 percent in 1970-71 to 15.5 percent in 1975-76 and remained constant thereafter till 1980-81). As a result, econometrically estimated equations using even weighted average of interest rates as one of the independent variables were not found to be meaningful. Therefore, interest rate has not been used in the supply and demand functions for credit. In the supply functions of final goods also, we had to use the volume of credit instead of interest rate.

Factors that influence demand for working capital are different from those that affect the demand for long term investment. In India most of the credit extended by commercial banks to the private sector is for financing working capital needs. However, we do not distinguish between commercial banks and long term lending institutions like IDBI.

household sector's subscription to shares and debentures issued by the business sector.

Note that FINSAV includes, among other things, bank deposits, currency and BONDS. We have ignored the problem of portfolio allocation by the household. Since we assume BONDS to be exogenously given and currency demand to be governed by currency supply (=DEFICIT), by Walras' law, the deficit has to be less than FINSAV - BONDS. Thus, although demand for currency is not explicit, there are limits to government's deficit financing that are implied by the model. (However, because of this assumption, this model is more suitable for analysing policies that bring about *small* changes in government deficit.)

2.3 Income, Income Distribution and Budget Constraints

A fraction (v_i) of the value of output at factor cost ($VO_i = S_i p_i$) of each sector (i) is assumed to accrue to the primary factors as value added (V_i). The gross domestic product (GDP) at factor cost is obtained as the sum of value added in all commodity sectors (i.e., GDP = $\Sigma_i V_i$). The wage income for each sector is obtained as a fixed share of the value added.

The value added from each sector is then distributed among five income groups each in urban and rural areas using a matrix of value added coefficients, using the procedure developed by Sinha et al. (1979), modified and extended by Drèze (1983). Profit income is assumed to accrue to the highest income bracket in the urban area[12]. The income accruing to the j'th income group, for example, is $\sum_{i=1}^{17} \sigma_{ij} V_i$ where σ_{ij} is the share of value added of sector i accruing to the j'th group ($\sum_j \sigma_{ij}$ = 1 for each i = 1,..., 17).

Note that it is difficult to find out the share of wage income within each income group. So we have computed wage income for each sector separately by applying a wage coefficient to the value added coefficient. Thus, we generate two parallel income distributions - one given by the incomes of the income groups that affect the demand for cotton and synthetic textiles directly through the calibrated demand functions, and the other given by the share of wage income in disposable income which is included in the demand equations of foodgrains and construction.

Similarly, since it is difficult to get information on the direct taxes paid by each income group, we assume that a fraction (DT) of GDP at factor cost is taxed away as direct taxes[13]. The household sector also receives a subsidy (SUBCD) from the government through the public distribution system of foodgrains. So the direct tax revenue (DTR) and the disposable income of the household (DY) are obtained as:

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[12] The five income groups for both rural and urban areas defined in terms of per capita monthly income in 1972-73 rupees are: 0-34; 34-43; 43-55; 55-75 and 75 and above. The distribution of population corresponding to the income groups are assumed to be the following for computing the Gini ratio: For rural areas, .254, .1957, .2058, .1897 and .1548; and for urban areas, .1241, .1504, .1939, .2273 and .3043.

[13] Since wage income is directly obtained from the pre-tax value added, it is implicitly not being taxed. Only non-wage income is taxed. An alternative tax rule could be that only the richest income class in the urban area is being taxed. This has been tried in Pradhan, Rath and Sarma (forthcoming).

$$DTR = DT \times GDP \tag{13}$$

$$DY = GDP - DTR + SUBCD \tag{14}$$

The household sector's budget constraint is given by,

$$SAV = DY - EXP \quad \text{where } EXP = \sum_{i=1}^{17} D_i q_i \tag{15}$$

where EXP denotes household sector's consumption expenditure and SAV is savings determined residually[14].

The budget constraint of the business sector is given by equation (10) above.

The government capital expenditure (i.e., public investment) and a part of current expenditure are taken to be exogenously given in real terms. (The conversion to current prices is done by using the price of capital goods in the case of public investment and general price index in case of other expenditures.) Expenditure on food subsidy (SUBCD) and additional transfers (ATR) (that might arise in the course of simulations) are endogenously determined. Thus, government expenditure in current prices (GE) is given by,

$$GE = PBI + GE_{exo} + SUBCD + ATR \tag{16}$$

where GE_{exo} is exogenous government expenditure and SUBCD is equal to

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[14] The demand functions were estimated using *gross* output as the dependent variable, whereas, ideally, final consumption should have been taken. So, for calculating final consumption expenditure, the value of output in each sector (say $D_i p_i$ for sector i) is multiplied by a constant fraction (c_i) taken from the input output table.

(Open market price of food - ration price) × Ration quota[15].

Major components of government revenue such as indirect taxes (ITR), direct taxes (DTR) and market borrowing (CRG) are computed endogenously. The other components (GR_{exo}) are assumed to be exogenously given. Thus, government revenue (GR) is computed as:

$$GR = DTR + ITR + CRG + ARM + GR_{exo} \tag{17}$$

where $ITR = \sum_{i=1}^{17} \tau_i VO_i$ and ARM, additional resource mobilisation, if any[16].

CRG and DTR are given by equations (9) and (13) respectively.

The government always meets its budget constraint by resorting to deficit financing whenever the need arises. Thus, its budget constraint is written as,

$$DEFICIT = GE - GR \tag{18}$$

Since all classes satisfy their budget constraints, Walras' law is verified. Note that the household sector is a net lender to the business and government sectors.

2.4 Prices

The prices of administered goods are assumed to be equal to their

[15] PBI reflects government's investment in construction and plant and equipment. Note that the aggregate demand equation for foodgrains in Appendix II includes a term INVTR denoting food stocks with the government. This term is treated as a policy variable for buffer stock operations. The investment on these stocks is clubbed with the exogenous component of government expenditure, GE_{exo}, in the base simulation.

[16] ATR and ARM are assumed to be zero in the base simulation.

average cost plus a mark-up, if any. We use an input-output table to compute their prices:

$$p_\alpha^t = \sum_{i=1}^{p} q_{i\alpha} p_i^t + \sum_{f=1}^{s} q_{f\alpha} p_f^t + l_\alpha w^t + k_\alpha r^t \qquad (19)$$

where p_α is the price per unit of a'th administered good, p_f is the price of f'th final good, $q_{i\alpha} = \frac{Q_{i\alpha}}{Q_\alpha}$ is the quantity of i'th good required to produce 1 unit of output of a'th good, $l_\alpha = \frac{L_\alpha}{Q_\alpha}$ is labour coefficient and $k_\alpha = \frac{K_\alpha}{Q_\alpha}$ the capital coefficient per unit of output of a'th good. The wage rate and rental rate are given by w and r respectively. Superscript t denotes time.

However, typically what one obtains from an input output transactions matrix are *value* coefficients ($a_{i\alpha}$, λ_α and ρ_α) pertaining to a particular base year rather than the quantity coefficients ($q_{i\alpha}$, l_α and k_α). That is,

$$a_{i\alpha} = \frac{Q_{i\alpha}^o p_i^o}{Q_\alpha^o p_\alpha^o} = q_{i\alpha} \frac{p_i^o}{p_\alpha^o}$$

$$\lambda_\alpha = \frac{L_\alpha^o w^o}{Q_\alpha^o p_\alpha^o} = l_\alpha \frac{w^o}{p_\alpha^o}$$

$$\rho_\alpha = \frac{K_\alpha^o r^o}{Q_\alpha^o p_\alpha^o} = k_\alpha \frac{r^o}{p_\alpha^o}$$

Superscript o refers to the base year.

To be able to interpret $a_{i\alpha}$ as quantity coefficients, often the unit of quantity is redefined such that value becomes equal to the new quantity (i.e. all prices become unity). This is done by defining that a new unit of quantity is equal to the amount that can be purchased at 1 rupee in the base year prices[17]. Equation (19) can now be written using value coefficients:

$$p_a^t = \sum_{i=1}^{9} a_{ia} p_i^t + \sum_{f=1}^{8} a_{fa} p_f^t + \lambda_a w^t + \breve{\rho}_a r^t \qquad (20)$$

Alternatively, instead of redefining quantities, if one assumes constant technology (i.e., quantity coefficients have not changed), equation (19) yields the following equation:

$$\frac{p_a^t}{p_a^o} = \sum_{i=1}^{9} a_{ia} \frac{p_i^t}{p_i^o} + \sum_{f=1}^{8} a_{fa} \frac{p_f^t}{p_f^o} + \lambda_a \frac{w^t}{w^o} + \rho_a \frac{r^t}{r^o} \qquad (21)$$

It is mentioned earlier that we compute value added from each sector as a fraction (v_j) of the value of output ($S_j p_j$). In other words, we assume that value added is a constant fraction (v_j) of the price (p_j). The implicit assumptions are that wage rates and rental rates have changed in proportion with the price[18]. That is, $\frac{w^t}{w^o} = \frac{r^t}{r^o} = \frac{p_j^t}{p_j^o}$. Then equation (21) becomes:

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17 Since according to this definition, 1 rupee buys 1 unit, Qp rupees would buy unit Qp units. So Q is now equal to Qp new units. The units of labour and capital are also altered similarly.

18 The implicit assumption is actually weaker than what we have assumed. It is sufficient to assume that the composite rate of return on all the factors that generate value added has changed in proportion with the price. We have made a stronger assumption because data on wage and rental rates are deficient.

$$\frac{p_\alpha^t}{p_\alpha^o} = \sum_{i=1}^{9} a_{i\alpha} \frac{p_i^t}{p_i^o} + \sum_{f=1}^{8} a_{f\alpha} \frac{p_f^t}{p_f^o} + (\lambda_\alpha + \rho_\alpha) \frac{p_\alpha^t}{p_\alpha^o} \qquad (22)$$

where $\lambda_\alpha + \rho_\alpha = v_\alpha$, the share of value added in price.

Using matrix notations, equation (22) can be rewritten as:

$$P'_\alpha = P'_\alpha B + P'_f D + P'_\alpha V_\alpha$$

or,

$$P'_\alpha = P'_f D \; (I - B - V_\alpha)^{-1} \qquad (23)$$

where P_α is the 9×1 vector of $\frac{p_\alpha^t}{p_\alpha^o}$, α=1,...,9; P_f is the 8×1 vector of $\frac{p_f^t}{p_f^o}$, f=1,...,8; D is 8×9 matrix of input output coefficients denoting use of non-administered goods by administered goods, $a_{f\alpha}$s; I is 9×9 identity matrix; B is 9×9 matrix of input output coefficients denoting use of administered goods by administered goods, $a_{i\alpha}$s; and V_α is 9×9 diagonal matrix of value added shares, v_αs .

All prices in the base year are known. B, D and V_α are computed from the input output table. Prices of non-administered goods are determined in the market and hence, once they are known, one can solve for the administered prices using (23).

The prices of goods produced in the private sector (i.e., non-administered goods) are obtained at market clearing levels. The estimated supply and demand equations are used for this purpose. Since the supply function are estimated and not directly related to the technology that determines the cost of production, there may be discrepancies between the market-determined prices and costs. We interpret these differences as taxes (or subsidies). We assume that such taxes or subsidies are added to the exogenous component of the government revenue or expenditure in equations (16) and (17)[19]. This is also consistent with our assumption that value added is a fixed fraction of the output in the non-administered sectors.

A general price index (GPI) is obtained as a weighted average of all commodity prices, the weights being value added coefficients normalized to 1[20].

Wage rates (nominal) are assumed to be rigid (except when there is wage indexation) reflecting excess supply of labour. The nominal rate of interest on bank credit is also rigid.

When wages are indexed

In some of our simulations, we assume that wages are partially protected against inflation in food prices. We follow the following procedure. Starting with a benchmark level of prices and wages etc. (denoted by putting a bar over these variables), if in the course of a simulation the food price rises above the bench mark level, we revise the wage rate upward by a fraction of the rate of increase in the food price. For example, if the protection factor is ϕ, then $w' = \bar{w}(1+\phi\Delta p)$ where w' is the revised wage rate, $\bar{w}$ is the initial wage rate and Δp is the percentage increase in the price of food relative to the

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19 This is done in the base simulation. During comparative static exercises, however, these taxes or subsidies are adjusted against additional resource mobilisation (ARM) or transfers (ATR).

20 Our index is different from the wholesale price index because we include price of services also, whereas the latter does not.

benchmark level. The wage hike is assumed to be fully passed on to the consumers through a rise in the price of the good concerned.

What will be the administered prices and the new value added shares?

For simplicity, let us use equation (19) and drop the time superscript. The new price will be written as:

$$p'_\alpha = \sum_{i=1}^{9} q_{i\alpha} p'_i + \sum_{f=1}^{8} q_{f\alpha} p'_f + l_\alpha \bar{w} \ (1 + \phi \Delta p) + k_\alpha \bar{r}$$

Or,

$$p'_\alpha - \bar{p}_\alpha = \sum_{i=1}^{9} q_{i\alpha} (p'_i - \bar{p}_i) + \sum_{f=1}^{8} q_{f\alpha} (p'_f - \bar{p}_f) + l_\alpha \bar{w} \phi \Delta p, \quad \alpha = 1, \ldots, 9 \qquad (24)$$

The benchmark prices $\bar{p}_\alpha$ and $\bar{p}_f$ are known. Again, $l_\alpha \bar{w} = \lambda_\alpha \bar{p}_\alpha$ by assumption. The market prices of non-administered goods, p'_f, are determined outside this system of equations and hence, once they are known, the administered prices p'_αs can be determined.

Since wages enter all prices, the value added shares v_is will get revised in all 17 commodity sectors. For each j = 1,...,17 the new wage and non-wage shares will be as follows:

$$\lambda'_j = \frac{l_j \bar{w} (1 + \phi \Delta p)}{p'_j} = \bar{\lambda}_j (1 + \phi \Delta p) \frac{\bar{p}_j}{p'_j}$$

$$\rho'_j = \frac{k_j \bar{r}}{p'_j} = \bar{\rho}_j \frac{\bar{p}_j}{p'_j}$$

Once the prices p'_js are known, $v'_j = \lambda'_j + \rho'_j$ get determined for all j's.

2.5 Equilibrium and Adjustment Mechanisms

The equilibrium is obtained when:

i. supply is equal to demand for each good produced in the private sector (i.e. in the final and capital goods block),

ii. supply is greater than or equal to demand for commodities produced in the public sector (i.e., in the administered goods block), and

iii. demand for credit does not exceed its supply.

Condition (i) is achieved through price adjustments. However, price flexibility is allowed only within pre-specified bounds which are chosen to reflect certain institutional rigidities. If there is excess supply at the floor prices, the excess is added to inventories. If there is excess demand with price hitting the upper bound, private demand is rationed. In such cases, budget constraints are suitably revised. (In most of our simulations, however, the equilibrium prices remained well within the bounds.)

Since public sector prices and interest rates are administered, conditions (ii) and (iii) are achieved through quantity adjustments. For administered goods, if demand exceeds supply, the shortfall is made up by imports[21]. Thus, imports (M) is given by[22],

$$M = \sum_{\iota=1}^{9} (D_{a} - S_{a}) \qquad (25)$$

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[21] This adjustment mechanism is used here for computational simplicity. Alternatively, demand for administered goods could be rationed according to some rule, which could be proportional rationing applicable to all user industries; or it could be governed according to priorities.

[22] This definition ignores the import of non-administered goods, which constitute about one-forth of India's total imports. We assume it to be exogenously given.

If demand for credit exceeds its supply, credit to the private sector is rationed. The implicit assumption is that the government can preempt its credit requirement by statutory provisions (e.g., the statutory liquidity ratio).

We treat exports as exogenously given and assume that the trade deficit is met through either a change in foreign exchange reserves or net inflow of debt. Because of this assumption, however, one has to account for the trade deficit while interpreting simulation results.

3. Non-Neutrality of Money

In our model, the non-neutrality of money (i.e., currency + bank credit) arises because (i) creation of currency is essential to the financing of public sector production; (ii) bank credit affects private production; (iii) there are price rigidities in the system, and (iv) the demand functions are not homogeneous of degree zero in prices and nominal income.

Although homogeneity of demand functions is essential to rule out money illusion on the part of individual consumers, it relies on certain highly unrealistic assumptions. If one includes interest income, for example, the budget constraint will be non-linear in interest rates. Or, if consumers take into account expected incomes, price expectations play a very important role, and homogeneity of demand function would require that price expectations be unit-elastic with respect to current prices. In the case of *aggregate* demand functions, homogeneity requires that the distribution of money among individuals remain invariant as money supply increases. This assumption is quite unrealistic in the presence of price rigidities. Imposition of homogeneity conditions on demand functions is, therefore, being increasingly questioned in the recent literature (Grandmont, 1983)[23]. In empirically estimated demand functions, the problems get accentuated because, in addition to the theoretical problems, there are also data problems (available price indices, for example, are far from satisfactory conceptually). Therefore, even if consumers are rational and optimizing, empirical demand functions are more likely to be non-homogeneous (of degree zero in prices and money income).

4. The Model at Work

The model is solved using a modified version of Scarf's fixed point algorithm developed by Saigal (1979). Given initial values of exogenous variables, we start with some arbitrary prices of final and capital goods. The administered prices are computed using the cost equation, given the input-output and value added coefficients. Supplies of capital goods by private sector and hence private investment are computed next. Using an arbitrary value of household savings in physical assets and the exogenously given BONDS, demand for credit by private sector is computed using equation (10). Supplies of

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[23] Lucas (1973) constructed a simple model of "money illusion", compatible with rational, optimizing behaviour. See also Sargent (1987).

final goods are obtained from the estimated equations. The value added coefficient matrix is applied to the supply vector (comprising all goods, including the exogenously given administered goods) first to determine income and its distribution between wage and non-wage income earners, and secondly, to obtain income distribution among five income groups each in urban and rural areas.

The share of wage and non-wage income affects directly the demand for foodgrains and construction, whereas the income distribution among five income groups affects directly the demand for cotton and synthetic textiles through the calibrated demand functions. Thus, both income and income distribution along with the arbitrary starting prices of final and capital goods yield the demand for non-administered goods. Demand for administered goods is obtained using equation (4). Then the household sector's consumption expenditure and savings in financial and physical assets are determined from equations (15), (11) and (12). Note that the savings in physical assets as implied by equation (12) may not be equal to the arbitrary value we assumed initially, and therefore the latter is replaced by the former in all subsequent iterations.

Government budget deficit is obtained using equations (16) through (18). That along with financial savings of the household determines the supply of bank credit.

Now supply of each sector (including financial sector) is compared to corresponding demand to verify equilibrium conditions. If there is excess demand (supply) for final and capital goods, the (arbitrary starting) prices are revised upwards (downwards)[24]. If there is excess demand for administered goods, it is made up through imports (equation (25)). In case of excess demand in the financial sector, private credit is rationed by rewriting equation (10) as:

$$CRP = S_{credit} - CRG \qquad (10')$$

In case of excess supply, the (excess) quantity is added to inventory or idle reserves for the administered and the financial sectors respectively.

After every price revision, all computations are repeated. The iteration continues till the equilibrium conditions are satisfied. Note that the dimension of the fixed point search routine is eight, because we have to compute only eight market clearing prices (six final and two capital goods).

In the base simulation, the model is solved using observed data on various exogenous variables for the year 1980-81 (given in Appendix III). The computed values of macro-variables are compared with their actual values for 1980-81 in Table 2.1 to check the explanatory power of the model. It is seen that the computed values of national income, public and private investment, government budget deficit and supply of bank credit are very close to their actual values. There are some

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24 Prices of final and capital goods are revised according to the following map:

$$p_i \longrightarrow \max\left\{\min\left(p_i + Z_i,\ \bar{p}_i\right),\ \underline{p}_i\right\}$$

where $Z_i = D_i - S_i$, the excess demand and $\bar{p}_i$ and $\underline{p}_i$ are upper and lower bounds respectively.

TABLE 2.1 : EQUILIBRIUM VALUES FOR 1980-81

ITEM	UNIT	COMPUTED VALUE	ACTUAL VALUE
1.Price Indices	Index with base 1970-71=100		
i. FG	"	185.15	206.28
ii. CNDNT	"	246.76	264.30
iii. CD	"	150.89	284.45
iv. C	"	310.25	269.28
v. PE	"	243.43	252.46
vi. SE	"	318.68	240.02
vii. TC	"	219.99	213.30
viii.TS	"	280.22	215.86
2.General Price Index	"	258.33	243.97
3.GDP at Factor Cost (Nominal)	Rs.'000 crores	119,265.6	114,021.0
4.GDP at Factor Cost (Real)	"	46,168.5	44,314.0
5.Public Investment in Cur. Prices	"	12,534.1	13,926.0
6.Private Investment in " "	"	20,414.5	17,492.0
7.Disp. Income of Hh. in " "	"	106,786.5	105,104.0
8.Wage Income in Current Prices	"	54,998.3	43,110.6
9.Household Saving	"	18,987.3	17,155.0
10.Govt.Expenditure in Cur.Prices	"	39,047.8	36,845.0
11.Govt.Revenue in Current Prices	"	35,657.0	33,394.0
12.Govt. Budget Deficit	"	3,390.8	3,451.0
13.Supply of Bank Credit	"	12,364.5	10,236.0
14.Demand for Bank Credit	"	8,192.4	10,236.0
15.Gini Coefficient (Rural)	Index	0.295389	-
16.Gini Coefficient (Urban)	"	0.278831	-

discrepancies in the sectoral prices, although the general price level is fairly close to the actual. It appears that sectoral variations are evened out at the macro level. This could be because, when macro identities are strictly adhered to, excess demand in one sector would tend to generate excess supply in another sector, and taken together, the discrepancies would cancel out.

In Table 2.2, we have presented the computed cost (in the base run) and the actual cost of the administered goods. The actual cost is calculated using actual prices of non-administered goods, whereas the computed cost is based on their computed prices. The computed cost reflects what an administered price ought to be for the consistency of supply and demand in the non-administered goods sector. Therefore, when the computed cost is greater (less) than the actual cost, the implication is that the good concerned is being subsidized (taxed)[25]. Thus interpreted, the subsidy on fertilizer as implied by these figures, for example, works out to be 300 crores of rupees whereas the actual subsidy on domestically produced fertilizer for 1980-81 was 170 crores of rupees. The wide discrepancy between the two figures can be attributed to the fact that our computed figure includes the indirect subsidy on fertilizer as well.

In a typical CGE model (Shoven and Whalley, 1984), the dimensionality of the search routine is reduced (to a tractable level) by solving only for factor prices and obtaining product prices as an algebraic sum of costs, the latter made possible by assuming CRS

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[25] As mentioned before, such taxes or subsidies are clubbed with the exogenous part of government expenditure or revenue in the base run.

TABLE 2.2 : COMPUTED COST PER UNIT* OF OUTPUT OF THE ADMINISTERED GOODS

ITEM	COMPUTED COST	ACTUAL COST	SUBSIDY (S)/ TAX (T)
1.Iron & Steel, Ferro-Alloys	1.4464	1.0417	S
2.Iron & Steel, Casting & Forging	1.5485	1.1351	S
3.Coal & Lignite	1.1600	1.2987	T
4.Crude Petroleum & Natural Gas	1.0667	1.3416	T
5.Electricity	1.3596	1.1126	S
6.Fertilizer & Pesticides	1.3325	1.0535	S
7.Cement	1.5254	1.2559	S
8.Industrial Raw Materials	1.0527	1.1889	T
9.Other Basic & Intermediate Goods	1.2262	1.3281	T

*The unit here is defined as the amount of output that could be purchased at 1 rupee in 1973-74 prices.

production functions. In contrast, our model solves for product prices alone. The dimensionality is reduced by using quantity adjustment in a number of sectors. The reason is that factor markets in India are either highly regulated (e.g., public sector capital and credit) or characterized by excess supply (e.g., labour). In addition, there are also severe limitations regarding availability of data.

Another contrast in our model is that we will not use the equivalent variation while evaluating simulation results. As will be clear later, we will interpret results by generally comparing real national income, inflation, income distribution and the trade deficit. Sometimes, however, it becomes difficult to interpret results unequivocally (when, for example, national income and trade deficit are both higher in one simulation than in another).

5. Conclusion

In sum, the non-Walrasian set-up, non-neutral money, financial intermediation in public as well as private production and use of statistically significant coefficients can be termed the highlights of our model.

The main weaknesses of the model are modelling of the external sector and absence of income group specific demand functions in all commodity sectors. We were also hampered by lack of a capital coefficients matrix. Also the estimation of parameters could be considerably improved by adopting suitable techniques. Another worthwhile exercise would be to go in for greater disaggregation of the financial sector.

Another important improvement can be brought about by endogenising the output of the administered sectors by relating them to the investment.

Chapter 3

PUBLIC SECTOR PRICE POLICY

With the growth of revenue from taxation and market borrowing attaining near saturation, the planners in many developing economies are today faced with the hard option of turning to the public sector enterprises for additional resources. In India, for example, the public sector is expected to contribute 32.7 per cent of the total outlay in the Seventh Plan as compared to only 16.8 per cent in the Sixth Plan. This is a tough target given that at present the central enterprises finance only one-third of their investment from own savings. Under these circumstances, the question of raising resources by upward revision of (public sector) administered prices merits a close examination.

The existing literature highlights the 'cost-push' aspect of an increase in administered prices [Gupta and Srinivasan (1984); Rangarajan, Sah and Reddy (1981), Jha and Mundle (1987)]. As summarized by the white paper on administered prices (WPAP) brought out by the Government of India (1986), the arguments run as follows: First, to the extent that the administered price constitutes a weight in the wholesale price index (WPI) the latter will go up when the former goes up. Secondly, since most of these administered prices correspond to basic intermediate goods, the cost of production of the user industries will increase. That will lead to an upward revision of the output prices, except when the corresponding demand curve is infinitely elastic. That will result in a higher WPI. Moreover, the increase in prices will eventually lead to a fall in outputs and income (except when the demand curves are completely inelastic).

There are difficulties with these arguments. First, these arguments are set within an input-output framework where there is no room for factor substitution so that if one input becomes costlier, it must lead to an increase in the cost. Note that an increase in the administered price of an input is like an indirect tax. If the taxed input is substitutable for other untaxed inputs, then the impact of the tax on the final price will be much less than what an input output model will imply. Secondly, if the final commodity for which the taxed commodity is an input is sold by a monopolist, part of the cost increase brought about by the tax on input will come at the expense of monopoly rents and to that extent, the effect on the price of final good will be dampened. Third, the way the additional revenue (generated due to the administered price hike) is spent will have wide implications on prices and income. For instance, if the additional revenue is used for reducing the government deficit, the money supply in the economy will go down, and there will be deflationary pressures on the prices (This aspect is discussed in the WPAP as well.) If the government decides to invest the additional revenue in capital goods, output and income in the economy may go up.

For analysing policies regarding administered prices, therefore, it is desirable to have a general equilibrium framework. Furthermore, given that administered prices are non-flexible by nature, the framework has to be non-Walrasian. In this chapter, we will use the CGE model described in the previous chapter to examine the macroeconomic implications of raising administered prices under various scenarios.

In the following section, we discuss some a priori implications of a hike in administered prices suggested by our model. Section 3 contains the simulation results. In Section 4, we summarize the results and conclude with a few remarks.

2. A Priori Implications of Raising Administered Prices

In our model, when an administered price is raised, all administered prices will increase because of the fixed coefficients technology. There will be cost-push pressures on the prices of non-administered goods also, although the pressures will be milder than in the case of administered prices because substitution among non-basic inputs is (implicitly) allowed.

Note that value added (in nominal terms) in each sector is obtained as a fixed fraction of the value of output. Therefore, whenever a price goes up, the income originating from that sector will also go up. Thus, every price effect will be accompanied by a nominal income effect.

The demand for final and investment goods are functions of prices and nominal income (and income distribution in some cases)[1]. The

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[1] As has been discussed in the earlier chapter, some of our demand functions are affected by nominal prices and nominal income, rather than relative prices and real income. Some of the results will be affected by such specification of demand functions undoubtedly.

demand for administered goods are derived using fixed coefficients and hence. they are also functions of the same variables as the non-administered goods. When an administered price increases, the demand vector will be affected negatively by price effects but positively by nominal income effects. Thus, the final effect on demand is not easy to predict. The situation is complicated further when effects of income distribution on demand is also incorporated.

The investment goods block forms an important link between the commodity markets and the financial market. The volume of investment determines the demand for financial credit which, subject to its availability, affects favourably the supply of goods and services. Thus, there is a strong correlation between the volume of credit and the level of income in the economy. Again, if there is an excess supply of credit, any decrease in the government deficit and hence money supply owing to additional revenue mobilised from the administered price hike may not have any deflationary effect on the prices.

Thus, the effects of raising the administered price of a basic input are too diverse for an a priori appraisal. The questions necessitate empirical investigation.

3. Simulation Results

An administered price can be raised in two ways: (i) to raise it and *freeze* it at a higher level in which case any subsequent escalation in the cost of production of the good concerned will be absorbed by the public enterprise itself; and (ii) to raise the *mark-up* over the cost so that any subsequent cost increase will be passed on to the consumers of the concerned good. In what follows we will be referring to the second policy. We will examine the implications of a one per cent rise in the administered prices of the following goods taking one at a time: (1) Iron and Steel, ferro-alloys; (2) Iron and steel casting and forging; (3) Coal and lignite; (4) Crude petroleum and natural gas; (5) Electricity; (6) Fertilizer and pesticides; (7) Cement.

We will analyse five schemes (policy packages):

Scheme I : An administered price is increased to reduce the government budget deficit (i.e., money creation).

Scheme II : In addition to Scheme I, wages are protected against increase in food prices.

Scheme III: In addition to Scheme II, the government resorts to buffer stock operations to check the rise in food prices.

Scheme IV : In addition to Scheme I, all consumers of food are subsidized.

Scheme V : Additional revenue generated from administered price hike is is distributed between the government and the concerned public enterprise.

3.1 Rise in Administered Prices to Mobilise Additional Resources (Scheme I)

In this scheme the government raises the administered price of a good (by 1 percent) to reduce its deficit. The results are summarized in Tables 3.1.a and Table 3.1.b. Evidently:

1. Every rise in the administered price leads to inflation ranging from 0.004 per cent in the case of cement to 0.016 per cent in the case of coal.

2. The income (GDP at factor cost) in nominal terms goes up at least as fast as the general price index (GPI) so that the real income (GDPFC R) improves, although only slightly.

3. The deficit in the government budget goes down, but not as much as the additional resource mobilised (ARM) from the price hike directly. For example, in the case of the ferro-alloys, the ARM is Rs.15.22 crores whereas the reduction in deficit is only Rs.11.44 crores. In the case of coal the ARM is Rs.11.53 crores but the deficit eventually goes up! The reasons are not far to seek: First, note that the addition to the government revenue is usually higher than the ARM reflecting the tax buoyancy in the economy. Second, government expenditure has gone up from the original level reflecting the increase in the costs of goods going for self-consumption. In the case of coal the government expenditure has gone up by Rs.20.6 crores underlining the fact that the government is one of the major consumers of coal. The addition to the total revenue in this case is, however, only Rs.20.17 crores (which is more than the ARM of Rs.11.53 crores) so that the deficit, in effect, goes up by Rs.0.43 crores.

4. The gross domestic capital formation in real terms (GDCF R) goes down because of the higher cost of basic inputs.

TABLE 3.1.a : RAISING ADMINISTERED PRICE BY 1 % - SCHEME I**

The ij'th entry in the table indicates the percentage change in the i'th price in response to a one percent increase of the j'th administered price.

SECTOR	ISF-A	ISC-F	COAL	PETROL	POWER	FERT	CEMENT
1. ISF-A	1.007	0.006	0.022	0.021	0.010	0.007	0.005
2. ISC-F	0.005	1.005	0.017	0.016	0.008	0.005	0.004
3. COAL	0.005	0.004	1.015	0.014	0.007	0.004	0.004
4. PETROL	0.004	0.004	0.014	1.013	0.006	0.004	0.003
5. POWER	0.008	0.007	0.026	0.025	1.012	0.008	0.006
6. FERT	0.004	0.003	0.012	0.011	0.005	1.004	0.003
7. CEMENT	0.003	0.003	0.010	0.010	0.005	0.003	1.003
8. IR	0.001	0.001	0.003	0.003	0.001	0.001	0.001
9. BIG	0.004	0.076	0.267	0.255	0.121	0.081	0.065
10.C	0.033	0.030	0.105	0.101	0.048	0.032	0.025
11.PE	0.084	0.046	0.161	0.153	0.073	0.049	0.039
12.FG	0.006	0.005	0.018	0.017	0.008	0.005	0.004
13.CNDNT	-0.004	-0.003	-0.013	-0.012	-0.006	-0.004	-0.003
14.CD	0.002	0.002	0.006	0.006	0.003	0.002	0.001
15.SE	0.000	0.000	0.001	0.001	0.000	0.000	0.000
16.TC	0.002	0.001	0.005	0.005	0.002	0.002	0.001
17.TS	0.001	0.001	0.004	0.004	0.002	0.001	0.001
18.GPI	0.005	0.006	0.016	0.015	0.007	0.005	0.005

**In SCHEME I (i) Administered price is raised by 1 % .
(ii)The additional revenue goes to finance the govt. deficit.

TABLE 3.1.b : RAISING ADMINISTERED PRICE BY 1 % - SCHEME I*

The ij'th entry in the table indicates the percentage change in the i'th variable in response to a one percent increase of the j'th administered price.

VARIABLE	ISF-A	ISC-F	COAL	PETROL	POWER	FERT	CEMENT
1. GDPFC R	0.000	0.000	0.001	0.001	0.001	0.000	0.000
2. INFLATION	0.005	0.005	0.016	0.015	0.007	0.005	0.004
3. GR R	0.045	0.016	0.040	0.054	0.126	0.034	0.020
4. GE R	0.012	0.010	0.037	0.035	0.017	0.011	0.009
5. DEFICIT	-0.338	-0.047	0.012	-0.154	-1.127	-0.225	-0.106
6. GDCF R	-0.024	-0.021	-0.075	-0.072	-0.034	-0.023	-0.018
7. DY	0.002	0.002	0.006	0.006	0.003	0.002	0.002
8. WY	0.002	0.002	0.005	0.005	0.002	0.002	0.001
9. OUTPUT							
i. FG	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ii. CNDNT	-0.001	-0.001	-0.003	-0.003	-0.001	-0.001	-0.001
iii. CD	0.006	0.005	0.019	0.018	0.009	0.006	0.005
iv. C	-0.040	-0.035	-0.126	-0.120	-0.057	-0.038	-0.030
v. PE	0.000	0.000	0.001	0.001	0.000	0.000	0.000
vi. SE	0.002	0.002	0.004	0.004	0.002	0.002	0.001
vii. TC	0.001	0.001	0.003	0.003	0.001	0.001	0.001
viii. TS	0.002	0.002	0.007	0.007	0.003	0.002	0.002
10.ARM **	15.229	4.988	11.528	16.631	43.646	11.271	6.474

*In SCHEME I (i) Administered price is raised by 1 %.
(ii)The additional revenue goes to finance the govt. deficit.

**ARM : Additional resource mobilised directly from the concerned sector - in crores of rupees in current prices.

5. As to the behaviour of prices and output at the sectoral level we observe three types of movements: (i) For consumer non-durables (CNDNT) both price and output decrease; (ii) For construction (C) price increases but output falls; and (iii) For all others, price as well as output moves up. Let us try to explain these movements with the help of diagrams [Figures 1, 2 and 3].

(i) The supply of consumer non-durables in our model is a function of credit and the price of industrial raw materials. As the administered price (of any good) increases, both increase, but the favourable effect of credit dominates so that the net effect is positive. Therefore the supply curve shifts rightwards (from S_o to S_1 in Figure 1). The demand for non-durables, however, is related positively to household expenditure and inversely to the price of foodgrains. It can be seen from the demand equation in Appendix II than the cross elasticity of demand with respect to the foodgrains price is as high as -1.249), which underscores the point point that when food prices rise, it is the consumer non-durables that are adversely affected rather than the consumer durables, quite unlike the usual belief. Consumer durables are part of the rich men's budget. The demand for the latter, therefore, remains unaffected when food prices rise; but the demand for the former goes down considerably. In this case, the effect of the food prices dominates the income effect, and the demand curve for consumer non-durables shifts leftwards (from D_o to D_1 in Figure 1). At the new equilibrium, both its price and output go down from the original level.

(ii) The case of construction is depicted in Figure 2. Given the

FIGURE - 1.

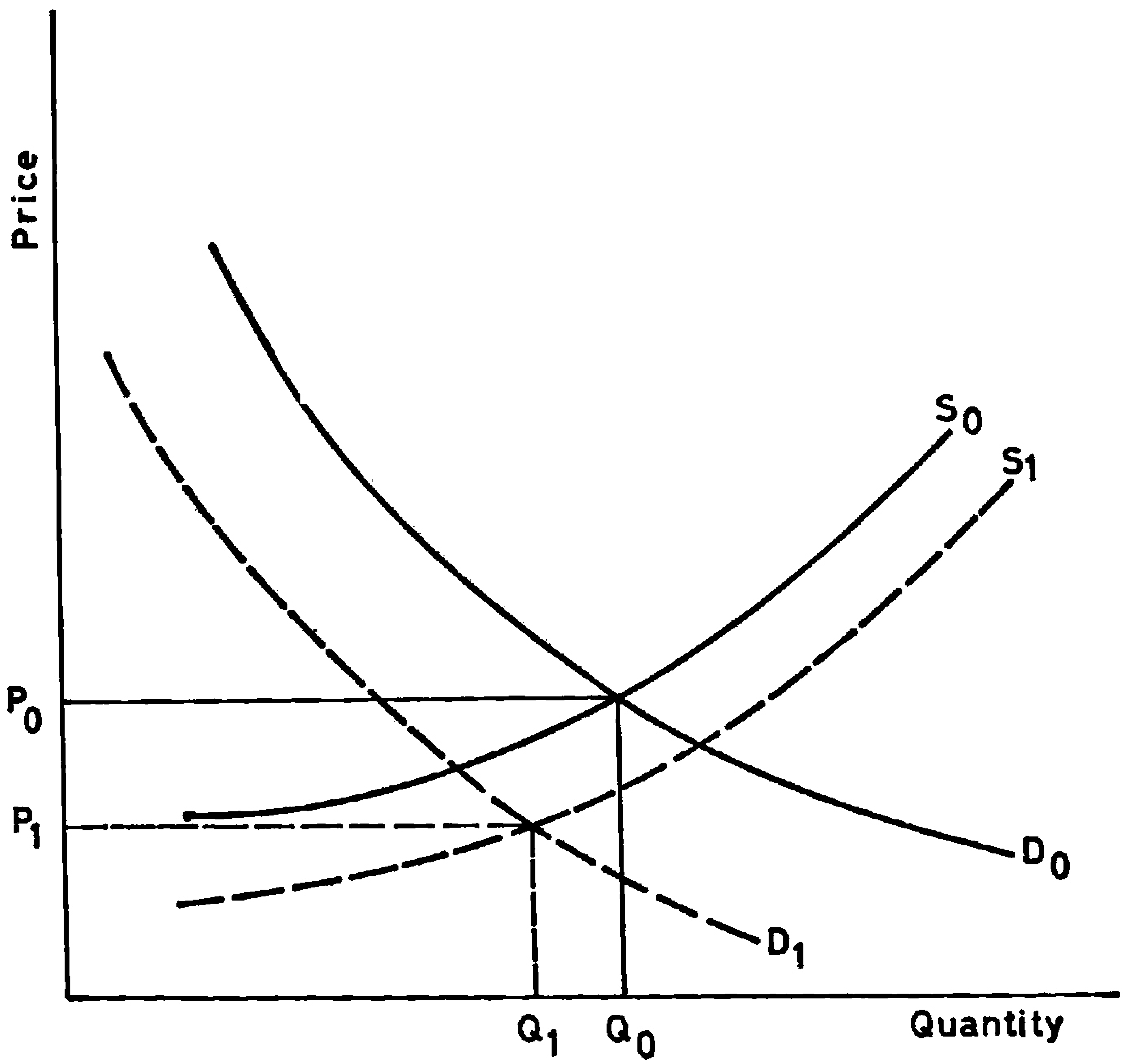


FIGURE - 2

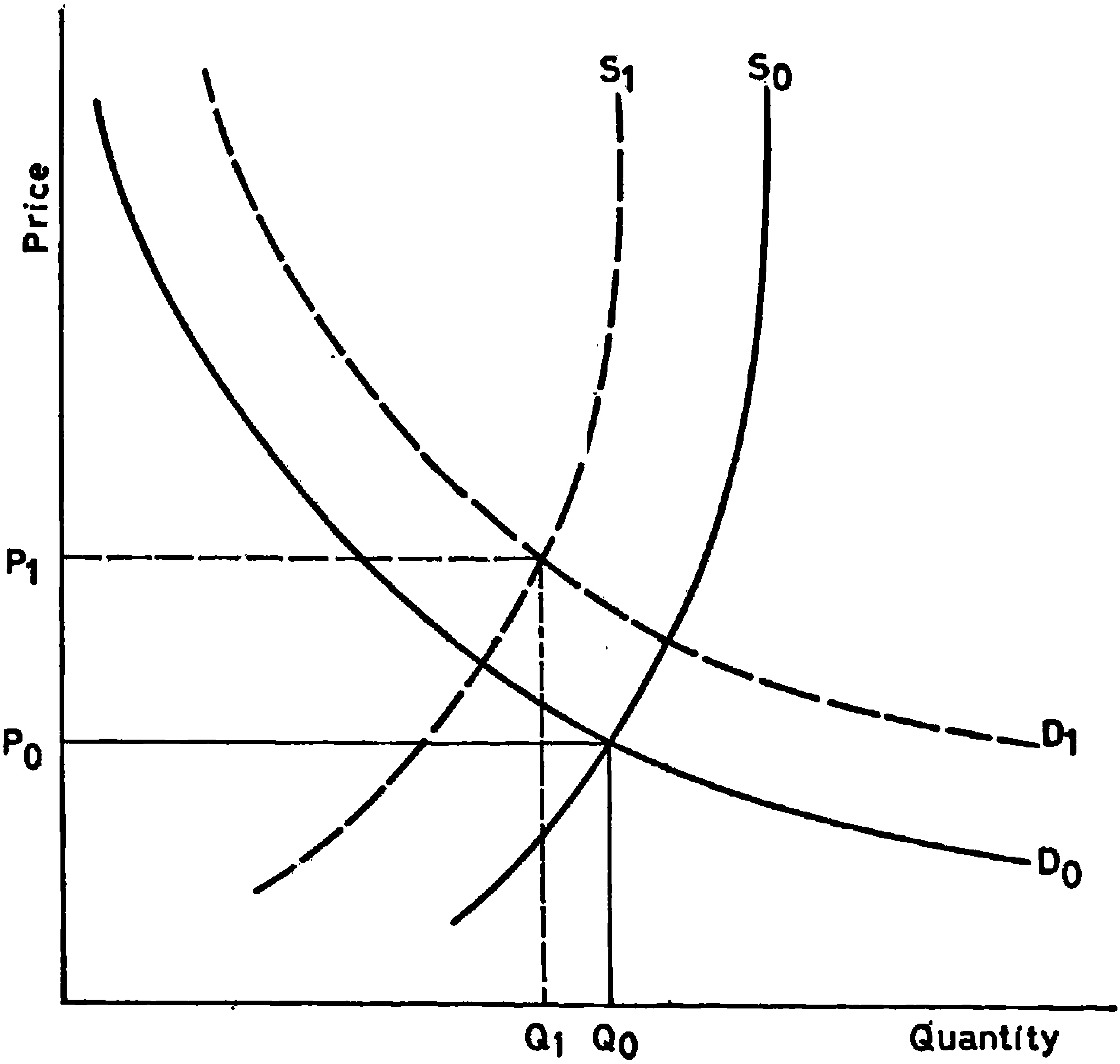
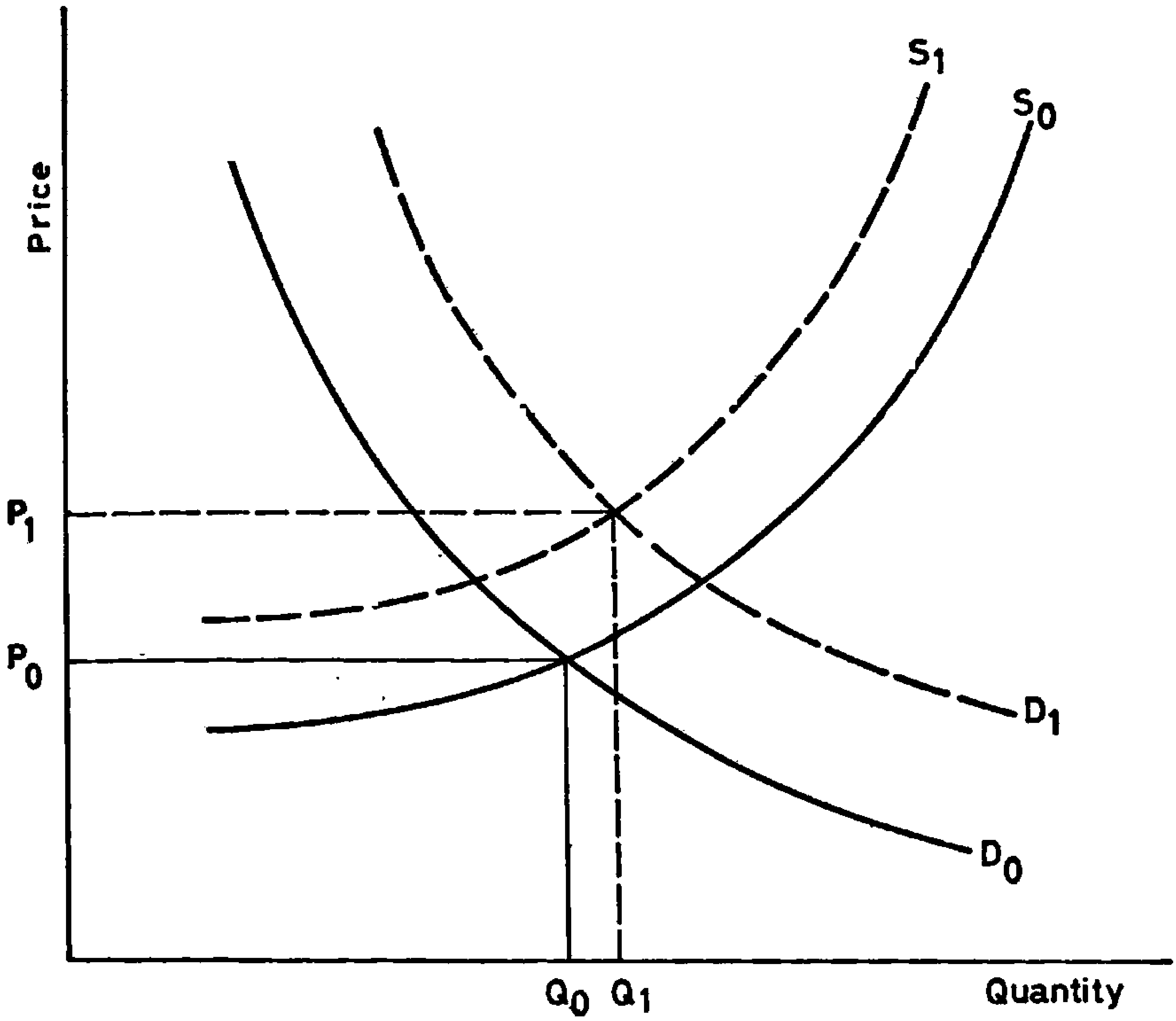


FIGURE - 3



specification of its supply and demand functions, the supply curve shifts leftwards (which implies a decrease in production due to increase in the cost of basic inputs) whereas the demand curve shifts rightwards. In equilibrium, the price is higher but the output is lower than the original level.

(iii) In the other sectors, both the curves move rightwards and, at equilibrium, the price as well as the output are higher than the original levels. The movements are illustrated in Figure 3.

3.2 Rise in Administered Prices When Wages Are Protected (Scheme II)

In this scheme the government raises an administered price by 1 per cent to reduce its deficit, but unlike the previous scheme, wages are protected against inflation in the food prices. We examine, in particular, the case where there is 25 per cent wage indexation, i.e., when wages are revised upwards by 0.25 per cent for every 1 per cent increase in the food prices[2]. When food prices fall, however, wages are not lowered, reflecting downward rigidity.

The results are presented in Tables 3.2.a and 3.2.b. It is evident from this table that:

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[2] This is equivalent to saying that only 25 percent of all the wage earners are organized and fully protected against food price rise. It is interesting to note that our model does not attain a solution when the wage indexation factor is higher than 0.25. Jha and Mundle (1987) found that this factor was close to 0.25 for both agricultural and non-agricultural sectors, although it was with respect to the wholesale price index.

TABLE 3.2.a : RAISING ADMINISTERED PRICE BY 1 % - SCHEME II**

The ij'th entry in the table indicates the percentage change in the i'th price in response to a one percent increase of the j'th administered price.

SECTOR	ISF-A	ISC-F	COAL	PETROL	POWER	FERT	CEMENT
1. ISF-A	1.339	0.335	0.351	0.350	0.339	0.336	0.334
2. ISC-F	0.330	1.332	0.341	0.341	0.332	0.330	0.328
3. COAL	0.529	0.528	1.544	0.538	0.531	0.526	0.528
4. PETROL	0.582	0.581	0.591	1.596	0.584	0.582	0.581
5. POWER	0.430	0.429	0.448	0.447	1.438	0.430	.4280
6. FERT	0.368	0.368	0.376	0.376	0.370	1.372	0.367
7. CEMENT	0.317	0.317	0.324	0.324	0.319	0.317	1.319
8. IR	0.301	0.301	0.303	0.303	0.302	0.301	0.301
9. BIG	0.429	0.428	0.438	0.437	0.431	0.429	0.428
10.C	0.369	0.365	0.441	0.436	0.383	0.368	0.361
11.PE	0.109	0.104	0.220	0.212	0.132	0.108	0.098
12.FG	0.837	0.837	0.850	0.849	0.840	0.837	0.836
13.CNDNT	-0.217	-0.216	-0.225	-0.225	-0.218	-0.216	-0.216
14.CD	0.277	0.277	0.281	0.281	0.278	0.277	0.276
15.SE	0.203	0.203	0.203	0.203	0.203	0.203	0.203
16.TC	0.235	0.235	0.239	0.238	0.236	0.235	0.235
17.TS	0.224	0.224	0.227	0.227	0.225	0.224	0.224
18.GPI	0.179	0.178	0.190	0.189	0.181	0.179	0.178

**In SCHEME II (i) Administered price raised by 1 %.
(ii)There is 25 % wage indexation w.r.t. the price of food grains.
(iii)The additional revenue goes to finance the govt. deficit.

LE 3.2.b : RAISING ADMINISTERED PRICE BY 1 % - SCHEME II*

ij'th entry in the table indicates the percentage change in the i'th variable in ponse to a one percent increase of the j'th administered price.

'ARIABLE	ISF-A	ISC-F	COAL	PETROL	POWER	FERT	CEMENT
GDPFC R	0.055	0.055	0.056	0.056	0.055	0.055	0.055
INFLATION	0.179	0.178	0.190	0.189	0.181	0.179	0.178
GR R	0.061	0.032	0.056	0.070	0.142	0.050	0.036
GE R	0.053	0.052	0.078	0.076	0.058	0.053	0.050
DEFICIT	0.147	0.260	0.498	0.331	-0.645	0.260	0.381
GDCF R	-0.048	-0.045	-0.099	-0.096	-0.058	-0.047	-0.042
DY	0.319	0.318	0.323	0.323	0.319	0.318	0.318
WY	0.321	0.321	0.325	0.325	0.322	0.321	0.321
OUTPUT							
i. FG	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ii. CNDNT	-0.162	-0.162	-0.164	-0.164	-0.162	-0.162	-0.162
iii. CD	0.455	0.455	0.468	0.467	0.458	0.455	0.454
iv. C	-0.076	-0.072	-0.162	-0.157	-0.094	-0.075	-0.067
v. PE	-0.017	-0.018	-0.016	-0.016	-0.017	-0.018	-0.018
vi. SE	0.070	0.070	0.073	0.073	0.071	0.070	0.070
vii. TC	0.130	0.130	0.132	0.132	0.131	0.130	0.130
riii. TS	0.361	0.361	0.366	0.366	0.363	0.361	0.361
).ARM **	15.268	4.992	11.568	16.702	43.806	11.307	6.494

*In SCHEME II (i) Administered price is raised by 1 %.
(ii)There is 25 % wage indexation w.r.t. the price of food grains.
(iii)The additional revenue goes to finance the govt. deficit.

*ARM : Additional resource mobilised directly from the concerned sector - in crores f rupees in current prices.
riginating from a wage hike. Since we assume the wage-hike to be

1. The real income increases at a uniform rate of 0.06 per cent *regardless of which administered price is raised.* So does wage income (WY) at a uniform rate of about 0.3 per cent. The other variables except the real investment also increase, although somewhat less uniformly. But we notice that although the direction of changes in the variables are maintained in this case as in Scheme I (i.e., price hike without wage indexation), the changes in the present scheme are many times magnified. The reason is that wages are more basic costs than the material costs. Because of indexation, for any initial increase in the food prices, wages in *all* sectors get revised at a uniform rate, so that in all subsequent rounds after the first, the effect on the macro-variables are almost uniform. The variations, if any, arise due to the effects of the first round only (as evident from Tables 3.1.a and 3.1.b). To elaborate, let us take the example of coal. When the price of coal is increased by 1 percent, food prices rise by 0.018 percent when wages are not indexed. When wages *are* indexed, for this 0.018 percent rise in food prices, wages in all sectors will get revised uniformly, and hence there will be an almost uniform escalation in the costs in all sectors. In other words, once wage indexation begins, the effects in the subsequent rounds are similar to those originating from a wage hike. Since we assume the wage hike to be uniform across sectors, the effects are also uniform. The reason why the magnitudes of changes are so magnified is that once wage indexation starts, the (cost) spiralling gets strengthened manifold. The spiralling also takes place due to demand-pull pressures, because the nominal disposable income of the households increases with each

wage revision.

2. The extent of changes are heightened at the sectoral levels also, although the direction of changes remain the same more or less. One noticeable exception is the plant and equipments sector where output registers a fall. The explanation is similar to the case of construction in Scheme I illustrated in Figure 2. The decline in the output of construction and plant and equipment leads to a fall in the real investment (GDCF R).

How does one justify the increase in real income simultaneously with a fall in the real investment? Let us first note that public investment is fixed in our model, so that if total investment has fallen, it is due to a fall in the private investment. That would show up in the form of a decline in the output of some sector(s) in this block. We observe that the output of consumer non-durables has declined, the reasons being the increase in the cost of raw materials and the fall in the demand for its product due to inflation in food prices. However, output of other final goods have gone up because their higher demands (owing to the income effect) are matched by higher supplies, realized via increased borrowing from the commercial banks by the business sector. The net effect is an increase in real income.

3. Another important fact to notice is that the government's budget deficit goes up with a price increase in each sector (except electricity, because, given the bulk of its output, a 1 per cent increase in its price generates a large revenue, and also because the government's own consumption of electricity is probably not as large

as other input goods). It reflects that the volume of wage paid by the government is enormous and, therefore, in the presence of wage-protection and large self-consumption, its very purpose of raising resources from administered price hike may turn out to be self-defeating.

3.3 Rise in Administered Prices With Protected Wages and Buffer Stock Operations (Scheme III)

In the two earlier schemes we noticed that the food prices are rising, but the government is holding on to its stock of foodgrains rather steadfastly. In this scheme, we relax this assumption and allow the government to release foodgrains to the open market to contain the rise in food prices when an administered price is raised (by 1 per cent) and there is (25 per cent) wage indexation.

Before we present the results, it is important to note that we assume the following sequence of policies in this scheme: First the administered price is raised and wage indexation is made operational as soon as the food price rises over a benchmark level[3]. Wage spiralling ensues and it is seen that food price increases monotonically due to cost-push as well as demand-pull pressures. At some point, the government starts releasing its buffer stocks of foodgrains to the open market. Food price starts falling, but since

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[3] This benchmark level was taken to be the computed value of the food price in the base simulation (= 185.15. See Table 2.1).

wages are rigid downwards, they remain high. Once food prices come down to the level where the government wants it to be, it stops releasing stocks (In other words, the effects of food price rise are finally eliminated, but the income effect of wage hike remains). Thus, the level of food price after which government starts its buffer operations and the level of food price where it stops are two crucial points in this chain. Obviously, the longer the government takes to intervene, the larger will be the wage spiralling. Again, the lower the target of food price stabilization, the larger will be the decumulation of government stocks.

We will present here the results pertaining to a situation where the government started its stock operations after the food price registered double digit inflation and continued till the food price was brought down to its original level[4]. The results, as presented in Tables 3.3.a and 3.3.b are striking:

1. The real income goes up by about 0.3 per cent for all sectors uniformly. At the same time inflation is also almost as much. The government revenue, inasmuch as it includes the proceeds of the

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[4] That is, government's intervention started after the food price touched the 200 mark and stopped after it went back to the original level of 185.15. We simulated this by setting the starting price of foodgrains to 200 and the lower bound on food price to 185.15. Once the lower bound is fixed, the private demand for foodgrains is determined. Subtracting that from the exogenously given supply of foodgrains, the stock of foodgrains left with the government at the new equilibrium is known. Thus, the extent of stock decumulation and hence additional revenue to the government are also determined. If we wanted to say that the government intervened very early to render wage indexation ineffective, we would have set the starting price at 185.15, the benchmark used for wage indexation.

TABLE 3.3.a : RAISING ADMINISTERED PRICE BY 1 % - SCHEME III**

The ij'th entry in the table indicates the percentage change in the i'th price in response to a one percent increase of the j'th administered price.

SECTOR	ISF-A	ISC-F	COAL	PETROL	POWER	FERT	CEMENT
1. ISF-A	1.506	0.500	0.519	0.518	0.505	0.501	0.499
2. ISC-F	0.478	1.482	0.492	0.491	0.481	0.478	0.477
3. COAL	0.601	0.601	1.619	0.612	0.604	0.601	0.600
4. PETROL	0.643	0.642	0.653	1.659	0.645	0.643	0.642
5. POWER	0.558	0.557	0.578	0.576	1.567	0.557	0.556
6. FERT	0.480	0.479	0.490	0.489	0.482	1.485	0.479
7. CEMENT	0.433	0.433	0.442	0.442	0.435	0.433	1.437
8. IR	0.270	0.270	0.272	0.272	0.271	0.270	0.270
9. BIG	0.519	0.519	0.529	0.287	0.521	0.519	0.518
10.C	0.437	0.434	0.511	0.506	0.452	0.436	0.429
11.PE	0.741	0.735	0.861	0.853	0.765	0.739	0.728
12.FG	0.000	0.000	0.000	0.000	0.000	0.000	0.000
13.CNDNT	0.363	0.363	0.362	0.362	0.362	0.363	0.363
14.CD	0.035	0.035	0.036	0.036	0.035	0.035	0.035
15.SE	0.353	0.353	0.356	0.356	0.354	0.353	0.353
16.TC	0.279	0.279	0.283	0.282	0.280	0.279	0.278
17.TS	0.265	0.265	0.269	0.269	0.266	0.265	0.265
18.GPI	0.333	0.332	0.346	0.345	0.335	0.332	0.331

**In SCHEME III (i) Administered price is raised by 1 %.
(ii)There is 25 % wage indexation w.r.t. the price of food grains.
(iii)The government releases food stocks to the open market to maintain the food price at the earlier level.
(iv)The additional revenue goes to finance the govt. deficit.

TABLE 3.3.b : RAISING ADMINISTERED PRICE BY 1 % - SCHEME III*

The ij'th entry in the table indicates the percentage change in the i'th variable in response to a one percent increase of the j'th administered price.

VARIABLE	ISF-A	ISC-F	COAL	PETROL	POWER	FERT	CEMENT
1. GDPFC R	C.341	0.341	0.347	0.346	0.343	0.341	0.341
2. INFLATION	0.333	0.332	0.346	0.345	0.335	0.332	0.331
3. GR R	0.251	0.222	0.249	0.262	0.332	0.239	0.225
4. GE R	0.071	0.070	0.096	0.095	0.076	0.070	0.068
5. DEFICIT	-1.493	-1.201	-1.166	-1.331	-2.292	-1.379	-1.257
6. GDCF R	0.066	0.069	0.017	0.020	0.056	0.067	0.072
7. DY	0.377	0.377	0.382	0.382	0.378	0.377	0.376
8. WY	0.445	0.445	0.451	0.451	0.447	0.445	0.445
9.OUTPUT							
i. FG	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ii. CNDNT	0.473	0.473	0.480	0.480	0.475	0.473	0.472
iii. CD	0.257	0.257	0.267	0.267	0.259	0.257	0.256
iv. C	-0.027	-0.023	-0.112	-0.107	-0.044	-.0262	-0.018
v. PE	0.216	0.216	0.221	0.220	0.217	0.216	0.215
vi. SE	0.159	0.159	0.163	0.063	0.160	0.159	0.159
vii. TC	0.154	0.154	0.156	0.156	0.155	0.154	0.154
viii. TS	0.428	0.428	0.434	0.434	0.429	0.428	0.427
10.ARM **	15.319	5.030	11.589	16.717	43.880	11.298	6.501
11.STOCK***	0.212	0.212	0.215	0.215	0.213	0.212	0.212

*In SCHEME III (i) Administered price is raised by 1 %.
(ii)There is 25 % wage indexation w.r.t. the price of food grains.
(iii)The govt. releases food stocks to the open market to maintain the food price at the earlier level.
(iv)The additional revenue goes to finance the govt. deficit.

**ARM : Additional resource mobilised directly from the concerned sector - in crores of rupees in current prices.

***STOCK : Indicates depletion of food grains stock - in million tonnes.

sale of additional foodgrains, goes up faster than the government expenditure resulting in a lower budgetary deficit. Even the real investment, which decreased in the earlier schemes, registers an increase here. The wage income also goes up.

2. At the sectoral level, the direction of shift in the supply and demand curves for construction is maintained as in the earlier schemes so that its price goes up but output falls (Figure 2). But the outputs of consumer non-durables and plant and equipment, which were going down earlier, are now rising. The increase in the output of plant and equipment more than makes up the fall in construction so as to result in an increase in real investment. Consumer non-durables now behave as in Figure 3, i.e., both supply and demand curves shift rightwards leading to a rise in price as well as output.

The behaviour of the sectoral output and prices is easily explained from the fact that once the price of foodgrains is stabilized, the upward movement in other variables such as income results in an upward shift in the demand curves. On the supply side, the increase in credit to the private sector (which reflects the increase in investment) outweighs the increase in the cost of inputs and the supply curves in all the sectors except construction move rightwards.

The price of consumer non-durables forms an important link in our model. When nominal income increases faster than the food prices, the demand curve for non-durables shifts to the right. This along with a similar shift in the supply curve leads to a higher price and output. That stimulates the demand for plant and equipment and its supply goes up despite the higher prices of the administered goods. The demand for credit goes up, and once they are met given the excess supply conditions in the credit sector, supply of other goods and services goes up as well. Thus the economy experiences an expansion in output accompanied by inflation. It is important to note here that this whole chain of expansion is set up *only if* income rises faster than the food prices. In the earlier schemes, the chain was never established.

As mentioned earlier, the wage income goes up so much, despite food prices being stabilized, because of the *sequence* in which the events take place in this scheme. First, an administered price is hiked. That leads to increased income which in turn pushes up the demand for most of the goods including foodgrains. The prices of these goods rise. The prices of foodgrains also rise. Now, since wages are indexed with respect to the price of foodgrains, wages rise. Income rises further and a chain is set up. At some point government intervenes to break this chain - it releases its stock of foodgrains to the open market to contain the food prices and, thence, the wage-spiral. It does succeed in stabilizing the food prices which in its turn fetches the additional benefits of an increase in investment, income and so on.

As has been emphasized earlier, the *timing* and extent of the government intervention are very important[5]. If it intervenes very

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5 Here we are *not* referring to actual time. This word is used to convey the length of the wage spiral.

early, say, when the food price is about to exceed the benchmark used for wage indexation, the wage spiral can never take off and the only consequences will be a small rise in investment, income and prices. For example, the real income will go up by about 0.002 per cent in case of iron and steel ferro-alloys, casting and forging, fertilizers and pesticides and cement, 0.007 per cent in case of coal and petroleum and 0.003 per cent in case of power. The inflation will be between 0.005 per cent (cement) to 0.019 per cent (coal). If it intervenes very late in the chain, after the food price has gone up to, say, 270, the growth in real income may be as high as 3 per cent and inflation, 2.9 per cent! In such a case, a 1 per cent initial hike in the price of coal may end up with an own cost increase of 6 per cent! But such a case is unlikely. The results presented above are from an exercise where the government intervenes at some interior point, after the food price has suffered double digit inflation[σ].

3.4 Rise in Administered Prices With Subsidy on Food Consumption (Scheme IV)

When wages are indexed to the food price, any disturbance that raises food price will result in a spiral with cost-push and demand-pull pressures feeding each other and leading to large inflation, although output may also go up in the process if there is

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[σ] It goes without saying that the government here has been assumed to be slow in reacting, reflecting to some extent the tardiness in its decision making processes.

excess capacity in the economy. Is it possible to contain the wage spiral by some alternative scheme other than buffer stock operation?

In this section, we examine the possible alternative of a subsidy scheme whereby the government pays to the consumers of food a subsidy of 0.25 percent for every 1 percent rise in the price of food (above a certain level) on each unit of food consumed. For convenience, we will call this a scheme of 25 percent consumption subsidy[7].

It is found that only this subsidy in the absence of wage indexation does not make much impact on prices and output although real income goes down somewhat. So we consider an alternative scheme *where there is 25 percent consumption subsidy and 25 percent wage indexation with respect to the subsidized price of food, i.e., the price of food net of the consumption subsidy*[8]. The results are presented in Tables 3.4.a and 3.4.b.

These results differ significantly from those of Scheme II (i.e., when there is wage indexation alone). It is seen that real income, wage income, inflation and real investment are less, while government

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[7] This subsidy is different from the ration subsidy that arises on account of the public distribution system. In this scheme, all consumers get the subsidy, irrespective of their incomes. and the subsidy is only partial in the sense only 25 percent of price increase above a certain level is compensated for. A 100 percent subsidy is not feasible on account of government's budget constraint. hence the partial subsidy.

[8] We also tried a scheme where there was 25 percent consumption subsidy on food and 25 percent wage indexation, but the latter was with respect to the *non-subsidized* price of food. When compared with the scheme described above, the results in this case were similar but heightened in extent. That is expected since by indexing wages to higher (market) prices of food, the wage spirals are expanded.

TABLE 3.4.a : RAISING ADMINISTERED PRICE BY 1 % - SCHEME IV-ii**

The ij'th entry in the table indicates the percentage change in the i'th price in response to a one percent increase of the j'th administered price.

SECTOR	ISF-A	ISC-F	COAL	PETROL	POWER	FERT	CEMENT
1. ISF-A	1.237	0.234	0.249	0.248	0.238	0.234	0.233
2. ISC-F	0.231	1.233	0.242	0.241	0.233	0.231	0.229
3. COAL	0.389	0.389	1.403	0.399	0.391	0.389	0.388
4. PETROL	0.430	0.430	0.439	1.443	0.432	0.430	0.429
5. POWER	0.310	0.309	0.327	0.326	1.316	0.309	0.308
6. FERT	0.266	0.266	0.274	0.273	0.268	1.268	0.265
7. CEMENT	0.231	0.230	0.238	0.237	0.232	0.231	1.232
8. IR	0.235	0.235	0.237	0.237	0.235	0.235	0.235
9. BIG	0.315	0.314	0.323	0.322	0.316	0.315	0.314
10.C	0.286	0.282	0.358	0.353	0.300	0.284	0.278
11.PE	0.019	0.014	0.128	0.121	0.042	0.018	0.007
12.FG	0.824	0.822	0.841	0.839	0.826	0.823	0.823
13.CNDNT	-0.232	-0.231	-0.242	-0.241	-0.234	-0.232	-0.231
14.CD	0.269	0.269	0.275	0.275	0.270	0.269	0.269
15.SE	0.132	0.132	0.132	0.132	0.132	0.132	0.132
16.TC	0.212	0.212	0.216	0.216	0.213	0.212	0.212
17.TS	0.202	0.201	0.205	0.205	0.202	0.202	0.202
19.GPI	0.125	0.125	0.136	0.136	0.128	0.125	0.124

**In SCHEME IV-ii (i) Administered price is raised by 1 %.
(ii)The additional revenue goes to finance the govt. deficit.
(iii)There is 25 % compensation on food price rise.
(iv)There is 25 % wage-indexation w.r.t. the price of food grains net of consn. subsidy.

TABLE 3.4.b : RAISING ADMINISTERED PRICE BY 1 % - SCHEME IV-ii*

The ij'th entry in the table indicates the percentage change in the i'th variable in response to a one percent increase of the j'th administered price.

VARIABLE	ISF-A	ISC-F	COAL	PETROL	POWER	FERT	CEMENT
. GDPFC R	0.028	0.028	0.029	0.029	0.028	0.028	0.028
. INFLATION	0.125	0.125	0.136	0.136	0.128	0.125	0.124
. GR R	0.052	0.023	0.047	0.061	0.133	0.041	0.027
. GE R	0.156	0.155	0.181	0.180	0.161	0.156	0.153
. DEFICIT	1.375	1.666	1.727	1.559	0.583	1.488	1.608
. GDCF R	-0.047	-0.045	-0.099	-0.096	-0.058	-0.047	-0.042
. DY	0.287	0.287	0.292	0.292	0.288	0.287	0.287
. WY	0.237	0.236	0.240	0.240	0.237	0.236	0.236
. OUTPUT							
i. FG	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ii. CNDNT	-0.193	-0.193	-0.197	-0.197	-0.194	-0.193	-0.193
iii. CD	0.417	0.416	0.432	0.431	0.420	0.417	0.416
iv. C	-0.062	-0.058	-0.148	-0.143	-0.080	-0.061	-0.053
v. PE	-0.038	-0.038	-0.037	0.037	-0.038	-0.038	-0.038
vi. SE	0.044	0.044	0.046	0.046	0.045	0.044	0.044
vii. TC	0.117	0.117	0.119	0.119	0.118	0.117	0.117
viii. TS	0.326	0.325	0.332	0.331	0.327	0.325	0.325
).ARM **	15.253	4.987	11.556	16.683	43.761	11.301	6.489

In SCHEME IV-ii (i) Administered price is raised by 1 %.
(ii)The additional revenue goes to finance the govt. deficit.
(iii)There is 25 % compensation on food price rise.
(iv)There is 25 % wage-indexation w.r.t. the price of food grains net of conso. subsidy.

ARM : Additional resource mobilised directly from the concerned sector - in crores rupees in current prices.

budget deficit is more in this scheme. Also there is no pattern in the changes in sectoral prices and output, implying that the two indexation rules significantly differ from each other.

An important distinction between wage indexation scheme and the consumption subsidy scheme is that wage indexation results in higher wages and hence it has inherent cost-push tendencies. Also, it is accompanied by positive income effects that give rise to demand-pull pressures. The consumption subsidy scheme, on the other hand, transfers resources from the government to the household sector so that it may generate demand-pull pressures. But it does not push up costs. To that extent, the consumption subsidy scheme is less inflationary than the wage indexation scheme. Moreover, since it covers only the consumption of food, its scope is narrower than that of wage indexation. Taken alone, therefore, this scheme will have less impact, in general, then the wage indexation scheme.

It is observed that both wage indexation and consumption subsidy combined together have less impact on real income, inflation and real investment than the wage indexation scheme alone (compare Tables 3.4.a and 3.4.b with Tables 3.2.a and 3.2.b). While a higher deficit in this case is understandable, the lower impact on other variables is mainly due to the fact that wages are indexed to the subsidized price of food and hence the wage spiral is smaller. The other reasons are that introduction of the consumption subsidy scheme significantly alters the sectoral composition of output and prices, acting mainly through the prices of foodgrains and consumer non-durables, both of which play crucial roles in demand determination.

In Scheme III we found that when food prices are stabilized, the price and output of consumer non-durables go up and national income goes up considerably. In the present scheme the prices of foodgrains increase faster than the nominal income and adversely affect the output of consumer non-durables and services, and ultimately the national income goes down. Putting these points together, it appears that stabilization of the prices of mass-based essential commodities is essential for growth.

3.5 An Alternative Scheme of Additional Resource Allocation (Scheme V)

We pointed out earlier that the implications of raising an administered price will vary according to the way the additional revenue is spent. In all earlier schemes, we assumed that the additional revenue mobilised (ARM) from price hikes is used for financing the government expenditure (or, in other words, for reducing the budget deficit). In the present scheme, we assume that a part of the ARM accrues to the public sector enterprise concerned and the rest goes to the government. The rule for distribution of the ARM between the two is assumed to be the same as that of the value of output of the concerned sector between material cost and value-added. The additional revenue thus accruing to the enterprise is assumed to be shared between wages and profits. (We do not allow investment for new capacity creation so the capacity constraints are still operative.)

The results are quite expected. Compared to Scheme I, the deficit reducing effect of the revenue raised is less. Again there is demand

TABLE 3.5.a : RAISING ADMINISTERED PRICE BY 1 % - SCHEME V**

The ij'th entry in the table indicates the percentage change in the i'th price in response to a one percent increase of the j'th administered price.

SECTOR	ISF-A	ISC-F	COAL	PETROL	POWER	FERT	CEMENT
1. ISF-A	1.016	0.009	0.029	0.023	0.023	0.010	0.006
2. ISC-F	0.017	1.008	0.026	0.019	0.025	0.010	0.006
3. COAL	0.008	0.005	1.017	0.015	0.011	0.006	0.004
4. PETROL	0.004	0.004	0.014	1.013	0.006	0.004	0.003
5. POWER	0.014	0.009	0.030	0.026	1.020	0.010	0.007
6. FERT	0.015	0.007	0.021	0.014	0.022	1.008	0.004
7. CEMENT	0.018	0.007	0.022	0.013	0.026	0.009	1.004
8. IR	0.007	0.003	0.008	0.004	0.010	0.003	0.001
9. BIG	0.090	0.077	0.271	0.256	0.129	0.083	0.065
10.C	0.053	0.036	0.121	0.105	0.078	0.040	0.028
11.PE	0.032	0.040	0.146	0.149	0.043	0.041	0.036
12.FG	0.086	0.030	0.081	0.035	0.132	0.037	0.015
14.CD	-0.024	-0.010	-0.028	-0.017	0.045	0.013	0.005
15.SE	0.022	0.007	0.018	0.005	0.034	0.009	0.003
16.TC	0.026	0.009	0.024	0.010	0.039	0.011	0.004
17.TS	0.024	0.008	0.022	0.009	0.037	0.010	0.004
18.GPI	0.019	0.009	0.027	0.018	0.029	0.010	0.006

**In SCHEME V (i) Administered price is raised by 1 %.
(ii) The additional revenue is shared between the government and the concerned public enterprise.

ABLE 3.5.b : RAISING ADMINISTERED PRICE BY 1 % - SCHEME V*

he ij'th entry in the table indicates the percentage change in the i'th variable in esponse to a one percent increase of the j'th administered price.

VARIABLE	ISF-A	ISC-F	COAL	PETROL	POWER	FERT	CEMENT
. GDPFC R	0.008	0.003	0.007	0.003	0.012	0.003	0.001
. INFLATION	0.019	0.009	0.027	0.018	0.029	0.010	0.006
. GR R	0.016	0.007	0.012	0.009	0.016	0.008	0.005
. GE R	0.011	0.010	0.036	0.035	0.015	0.011	0.009
. DEFICIT	-0.027	0.049	0.320	0.329	0.036	0.047	0.058
. GDCF R	-0.013	-0.018	-0.066	-0.069	-0.017	-0.019	-0.017
. DY	0.035	0.012	0.032	0.013	0.053	0.015	0.006
. WY	0.038	0.013	0.034	0.013	0.059	0.016	0.006
. OUTPUT							
i. FG	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ii. CNDNT	-0.014	-0.005	-0.014	-0.006	-0.022	-0.006	-0.003
iii. CD	0.051	.019	0.054	0.028	0.077	0.023	0.010
iv. C	-0.021	-0.030	-0.111	-0.116	-0.029	-0.031	-0.028
v. PE	-0.001	-0.001	0.000	0.001	-0.002	-0.001	0.000
vi. SE	0.009	0.004	0.010	0.006	0.013	0.004	0.002
vii. TC	0.014	0.005	0.013	0.005	0.022	0.006	0.002
viii. TS	0.039	0.013	0.036	0.015	0.060	0.017	0.006
0.ARM **	15.273	4.987	11.540	16.63	43.902	11.290	6.474

*In SCHEME V (i) Administered price is raised by 1 %.
(ii)The additional revenue is shared between the government and the concerned public enterprise.

*ARM : Additional resource mobilised directly from the concerned sector - in crores of rupees in current prices.

effect coming through from the distribution of part of the revenue to workers as wages. Consequently, there is a positive growth of income accompanied by inflation.

3.6 Income Distribution

As mentioned earlier, the value-added in each sector of the economy is distributed among five income groups each in the rural and the urban area. We assume that the distribution of population in each income group remains unaltered. For each of the schemes discussed in the previous section, we compute the Gini index for the rural area and the urban area separately. Table 4 summarizes the results.

It is observed that the Gini ratios are strongly correlated to the inflation rate, although the correlation is negative in the rural areas and positive in the urban areas. It is probably true that the rural masses are not as much affected by inflation as are the urban poor. That is because the degree of 'monetisation' is less in rural areas, the bulk of economic activities being carried out through kind payments. The rural population, therefore, is less affected by changes in the nominal prices of goods and services. The urban populace, on the other hand, is more vulnerable to inflation because wages are only partially protected and even so, it is well-known that they are revised only with a lag[9].

[9] This explanation is not derived from the model. Nevertheless, it is an interesting conjecture.

TABLE 4 : EFFECT OF INCREASING ADMINISTERED PRICE ON INCOME DISTRIBUTION*

The ij'th entry in the table indicates the percentage change in the Gini ratio in response to a one percent increase of the j'th administered price.

GINI RATIO	ISF-A	ISC-F	COAL	PETROL	POWER	FERT	CEMENT
URAL							
. SCHEME I	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
. SCHEME II	-0.017	-0.017	-0.017	-0.017	-0.017	-0.017	-0.017
. SCHEME III	-0.025	-0.025	-0.025	-0.025	-0.025	-0.025	-0.025
. SCHEMEIV-ii	-0.011	-0.011	-0.012	-0.012	-0.012	-0.011	-0.011
RBAN							
SCHEME I	0.001	0.001	0.004	0.004	0.002	0.001	0.001
SCHEME II	0.046	0.046	0.048	0.048	0.046	0.046	0.045
SCHEME III	0.063	0.062	0.065	0.065	0.063	0.063	0.062
SCHEMEIV-ii	0.036	0.036	0.038	0.038	0.036	0.036	0.035

For description of the schemes, see text (section 3) and also the tables given rlier in this section.

3.7 Imports

The results pertaining to imports are presented in Table 5. The import bill goes down in most cases except Scheme III. In Scheme III, it goes up uniformly by about Rs.65 Crores; but the increase in the national income is much higher, at about Rs.400 crores (a 0.1 per cent increase in national income is equal to nearly Rs.120 crores). It is important to note the high degree of correlation between imports and the gross domestic capital formation observed in all the schemes. A decrease in investment (which occurs due to an increase in the costs of inputs) leads to a reduction in the derived demand for the intermediate goods resulting finally in a contraction of the import bill (Recall that imports are defined as the excess of demand over the domestic production of administered goods - the latter is assumed to be given).

4. Conclusion

The broad results that emerge from our exercises are:

1. When the price of any public sector product is increased, the general price index increases. Since surplus of the public sector increases in general, it helps to mobilise some additional resources. However, in certain cases (like coal), increasing the administered price results in an *increase* in the government deficit.

2. There is a positive relation between inflation and the

ABLE 5 : EFFECT OF INCREASING ADMINISTERED PRICE ON IMPORTS*

he ij'th entry in the table indicates the change in imports (in rupees crores) in esponse to a one percent increase of the j'th administered price.

IMPORTS	ISF-A	ISC-F	COAL	PETROL	POWER	FERT	CEMENT
. SCHEME I	-0.50	-0.43	-1.61	-13.03	-0.72	-0.47	-0.37
. SCHEME II	-75.04	-74.97	-76.14	-87.54	-75.26	-75.02	-74.93
. SCHEME III	66.50	66.44	67.53	56.00	66.73	66.50	66.39
. SCHEMEIV-i	-89.03	-88.98	-90.38	-101.77	-89.36	-89.08	88.93
. SCHEMEIV-ii	-66.95	-66.88	-68.32	-79.68	-67.16	-66.94	-66.87
. SCHEME V	8.73	1.03	-1.08	-16.87	-0.09	4.17	0.62

* For description of the schemes, see text (section 3) and also the tables given arlier in this section.

growth of real income.

3. When wages are indexed with respect to food prices, the extent of inflation is much higher; but the growth rate also increases significantly. It is also worthnoting that the rate of growth, inflation and other macro-variables are affected almost uniformly by the increase in the price of *any* public sector product. This is due to the fact that the indirect effects of wage indexation are much stronger than the direct effects of a price rise.

4. Although there is a positive relation between inflation and growth, the rate of growth varies significantly with the source of inflation. For example, if price of foodgrains increases at a faster rate than nominal income, the demand for non-durables and services decreases. This leads to a decrease in private investment in plant and equipment and construction. At the same time, the demand for goods like consumer durables and synthetic textiles increases. This has two implications : (i) the overall rate of growth is not very high although it turns out to be positive and (ii) the group of people who consume commodities like consumer durables *benefit* by the rise in food price while the consumers of mass-based manufactured goods are affected adversely. This suggests that stabilizing food prices will be conducive to growth as well as income distribution.

5. When the government stabilizes the prices of food grains by depleting its stocks, growth rate increases considerably. Although inflation is high, the supply of mass-based manufactured goods and private investment also increase. The success of such a measure, however, will depend upon the volume of buffer stock available with

the government. Our findings suggests that subsidizing food is not only equitable, but is also essential for growth.

6. When wages are indexed to the food prices, the timing of government intervention in the form of releasing stocks becomes very crucial. When the price of foodgrains rises, it stimulates a rise in the wages in all sectors. This in turn leads to an increase in the demand for foodgrains and, hence, a further rise in their price and a fresh round of wage revision. For maintaining growth with a tolerable rate of inflation, the government must intervene as soon as the rise in the general price level reaches the tolerable limit. Any early intervention will decrease growth while a later intervention cannot control inflation.

7. There is a strong correlation between Gini ratio on one side, and growth and inflation on the other, although for rural areas the correlation is negative and for urban areas it is positive.

However, these results should be evaluated after attaching due weights to the various macro-variables such as the national income, income distribution and trade deficit. Investment forms the link between the present and future and, therefore its behaviour ought to be carefully monitored while making policy conclusions for the long run.

Chapter 4

FOOD SUBSIDIES

The current account of the Indian government turned into a deficit during the financial year 1979-80 and the deficit has been growing from 0.6 percent of GDP in 1979-80 to 2.4 percent in 1985-86. Hence resources had to be raised in the capital account, not only to finance the plan, but also to balance the current account. During this period, the subsidies have increased from 1.4 percent of GDP to 2 percent. Among the subsidies, food and fertilizers accounted for 75 percent in 1985-86, while it was 60 percent in 1980-81 and only 19 percent in 1970-71. Under these circumstances, there have been suggestions to reduce, or at least contain, the growth of food and fertilizer subsidies. In this chapter, we will apply the model developed in Chapter 2 to examine the possibility as well as desirability of reducing food subsidies.

In many developing countries, the per capita availability of essential goods is low and the distribution of income is highly skewed. In a free market economy, consumers with low incomes can purchase necessary amounts of these goods only if the prices are low. The supplies will increase if the producer prices are high. In view of this, governments often provide subsidies to consumers and producers. This is done in a number of ways. For example, the government can buy at a high price from the producers and sell to the consumers at a low price through a public distribution system (PDS). Alternatively, the government can provide fertilizer or irrigation at subsidized prices.

Such policies will affect not only the production and distribution of essential goods but also the demand and supplies of other goods and services. When consumers spend less on essential goods, they will have more money to spend on others. Hence there will be a shift in the demand for other goods. At the same time the government has to levy some taxes or borrow funds to finance the subsidies. This in turn may shift the demand curves for goods and the supply curve for funds. Thus the effects of any policy will be wide spread and ought to be studied within a general equilibrium framework. The government interventions through price subsidies restrict the flexibility of the price mechanism. Hence a non-Walrasian general equilibrium framework will be appropriate.

Here we use our model to study the following questions:

1. What are the effects of reducing the subsidies to the food sector on important macrovariables like growth rate and income distribution?

2. How do such subsidies affect production and distribution of various goods and services and the government budget?

We define food subsidy in the next section and present the simulation results in Section 3. Section 4 contains concluding remarks.

2. Definition of Food Subsidy

The government decides to distribute a certain amount through the PDS at the ration price in each period. Since supplies of foodgrains fluctuate with weather conditions, the government has to carry a buffer stock to ensure a regular supply to the PDS. In addition, the government may have to carry some additional stocks for giving price support to the farmers. The volume of expenditure that the government has to incur will be determined by the difference between the procurement price and the ration price, and also by the carrying costs. It will also depend upon the size and the composition of the stocks.

How do we define food subsidies? A partial equilibrium approach is the following. In a given year, the food subsidy is the excess of expenditure over the revenue accruing to the government from the food sector. That is,

$$FS = (p_{FG} - p_r)\ Q + \theta\ R\ p_s \qquad (1)$$

where FS is the food subsidy, p_{FG} is the market price, p_r is the ration price (i.e., the price at which foodgrains are supplied through the PDS), Q the quantity distributed through the PDS, R the additional stocks arising out of support price operations and p_s is the support price (i.e., the price at which the government is prepared to buy whatever quantity is offered to it)[1]. θ is the carrying cost of a rupee worth of stocks. This will include the cost of storage, maintenance, interest and risk premium[2]. The ration and the support prices in this equation are exclusive of the carrying

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[1] The first term in the r.h.s. of this equation is nothing but SUBCD as defined in Chapter 2 above.

[2] The cost of carrying stocks was placed at rupees 23.62 per quintal for 1977-78 and rupees 26.51 for 1980-81 by Kahlon and George (1985, p 233).

costs.

Ideally the ration subsidy should be defined as the difference between procurement price and the ration price multiplied by the ration quota. Note that the excess reserves, R, will be positive only when there is excess supply of foodgrains in the open market with the support price operating as a floor. Under such a situation, the market price, p_{Fa}, will be equal to the support price which is also equal to the procurement price in India[3]. Hence we use market price instead of the procurement price in equation (1). Moreover, since the stock of foodgrains at a point of time is the result of stocks procured over a long period at different procurement prices, the question as to what price to use for its evaluation is difficult to answer. For simplicity, we will assume that stocks are evaluated at their opportunity costs, that is, the ruling market prices. In other words, this working capital is evaluated at replacement cost.

We call (1) a partial equilibrium definition because it is specific to the foodgrains sector alone. However, as we already pointed out, any change in the food subsidies will affect all other sectors of the economy. Consequently, the budget constraint of the government will be affected both on the expenditure side as well as the revenue side. A general equilibrium definition of the food subsidies, therefore, should concentrate on the government budget deficit. As we shall see presently, the two definitions will differ

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[3] Procurement price is what the government pays to procure foodgrains for its buffer stock. Theoretically it is different from the support price. In India, however, only one price is used for both procurement and support operations.

significantly.

3. Simulation Results

It may be recalled from Chapter 2 that supply of foodgrains is assumed to be given in our model, reflecting its dependence on the monsoon. Private demand for foodgrains is econometrically estimated as a function of food price, income distribution as given by the share of wages in disposable income and private consumption expenditure. Government is assumed to hold some stock of foodgrains (INVTR) and depending on the policy scenario, the stocks are fixed exogenously or determined residually as the difference between the supply and the private demand[4]. There is also a dual pricing scheme for foodgrains modelled according to Chetty and Jha (1986). Accordingly, the demand equation is modified by using a weighted average of the free market price and the ration price and adding the ration subsidy to the disposable income[5].

In our simulation exercises, we will examine the following six schemes:

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[4] INVTR = Buffer stock + Excess reserves (R). In India, the buffer stock is fixed (at 10 million tonnes) according to the recommendation of a Technical Group on Buffer Stock Policy (Economic Survey (1986-87)). In our simulations, when support operation is not on, excess reserve R is zero and INVTR = Buffer stock, which is exogenously fixed. When support operations are on, market price is equal to the support price and R becomes endogenous. INVTR is then endogenously determined as supply minus private demand.

[5] The weight used for averaging the two prices was assumed to be 0.5. One interpretation of this weight is that it is the proportion of population which avails PDS facilities. There can be other interpretations too (Jha 1986).

Scheme I : The ration price is increased by 10 percent.

Scheme II : The ration quota increased by 1 million tonne.

Scheme III: Scheme I and Scheme II combined.

Scheme IV : Scheme III with a 1 percent increase in the price of fertilizer.

Scheme V : Scheme II with a 1 percent increase in the price of fertilizer.

Scheme VI : The price of fertilizer is increased by 1 per cent; there is 25 percent wage indexation with respect to food prices and R is decreased by selling in the open market.

It is important to note that whenever the ration quota, Q, is increased, the required foodgrains are taken from the existing stocks. In other words, when Q is increased by 1 million tonne, R decreases by the same magnitude. Notice from equation (1) that this switch from R to Q will lead to a reduction in food subsidy as long as $(p_{FG} - p_r)$ is less than θp .

Any of the above measures would bring about a reduction (if any) in food subsidy in three ways:

(i) It may generate some additional revenue, RR, from the PDS because of changes in ration quota or ration price.

(ii) It may generate some additional revenue, RS, from the reduction in excess reserves or support price.

(iii) There may be some additional revenue, RF, generated by any other measure such as, say, a 1 percent hike in the price of fertilizer.

Thus.

$$\text{Reduction in food subsidy} = RR + RS + RF \qquad (2)$$

where

$$RR = Q^1 p_r^1 - Q^0 p_r^0$$

$$RS = \theta (R^0 p_s^0 - R^1 p_s^1)$$

$$RF = D_{FERT} \times P_{FERT} \times 0.01$$

D_{FERT} denotes the demand for, and p_{FERT} the price of, fertilizer. Superscript 0 and 1 respectively refer to the initial and the new values of the variables.

The effects of each of these six schemes are studied under two situations:

I. When the market price is stabilized by fixing a support price equal to the former.

II. When the support price is 20 percent lower than the current market price.

Government's support operations are simulated by fixing the lower bound on the price of food to be equal to the support price. That puts an upper bound on the private demand for foodgrains, given the income and income distribution. The difference between supply and private demand then determines the stocks with the government (INVTR). Changes in stocks relative to the base simulation (of Chapter 2) reflect changes in excess reserves[σ].

Situation I : When Support Prices Are High

In this section we examine the various schemes for reducing food subsidy when the minimum support prices are as high as the corresponding base period market prices. In other words, the market prices are stabilized by the government through buying and selling of stocks at appropriate junctures. The results are presented in Tables 1 and 2. It is evident from Table 1 that:

1. Food subsidy is going up instead of down under all schemes except Scheme VI, and this perverse result is more pronounced in all the cases involving the 10 per cent increase in ration price(i.e., Schemes I, III and IV), while they are somewhat subdued in cases involving a 1 million tonne increase in ration quota (Schemes II and V).

2. Reduction in government deficit is significantly different

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σ In contrast to our specification, Narayana et al. (1987) endogenise the quantity of foodgrains procured (which in their model is also equal to the quantity distributed) by using estimated equations where the arguments are availability of foodgrains over the previous two years and the consumption level of the urban population. They also fix the support price and equilibrate the food market by adjusting trade quotas.

TABLE 1

REDUCING FOOD SUBSIDY WHEN PROCUREMENT PRICES ARE HIGH: MACRO-VARIABLES

Variable	Scheme I	Scheme II	Scheme III	Scheme IV	Scheme V	Scheme VI
1.Redn. in Food Subsidy in Rs. Crores(i+ii+iii)	-317.28	- 90.56	-402.85	-391.35	- 79.08	22.08
i. RR#	93.13	62.49	161.87	161.87	62.49	0.00
ii. RS#	-410.41	-153.05	-564.72	-564.54	-152.84	10.80
iii. RF#	0.00	0.00	0.00	11.32	11.27	11.28
2.Redn. in Deficit in Rs. Crores	-407.02	-180.59	-583.39	-575.31	-172.61	20.24
3.Redn. in Food Stocks in Million Tonnes	-2.591	0.034	-2.565	-2.564	0.035	0.068
4.Change in GDPFC# (%)	-2.485	0.037	-2.457	-2.456	0.039	0.110
5.Inflation (%)	-1.375	0.017	-1.362	-1.356	0.023	0.109
6.Change in Gini Coefficient - Rural (%)	0.063	-0.000	0.063	0.063	-0.000	-0.008
7.Change in Gini Coefficient - Urban (%)	-0.152	0.003	-0.149	-0.148	0.005	0.021

\# RR : Additional revenue that accrues from the ration shops.
RS : Additional revenue accruing from the release of stocks in the open market.
RF : Additional revenue accruing from the hike in fertilizer price.
GDPFC : Gross domestic product at factor cost at constant prices.

TABLE 2

REDUCING FOOD SUBSIDY WHEN PROCUREMENT PRICES ARE HIGH: SECTORAL OUTPUT

Output	Scheme I	Scheme II	Scheme III	Scheme IV	Scheme V	Scheme VI
1. Foodgrains	0.000	0.000	0.000	0.000	0.000	0.000
2. Consumer non-durables	-5.284	0.052	-5.245	-5.243	0.055	0.152
3. Consumer durables	1.423	0.020	1.438	1.442	0.024	0.085
4. Construction	-0.477	0.011	-0.468	-0.506	-0.027	-0.034
5. Plant and equipment	-1.985	0.020	-1.970	-1.968	0.022	0.069
6. Services	-0.777	0.008	-0.772	-0.770	0.010	0.052
7. Cotton textiles	-0.323	0.017	-0.309	-0.309	0.018	0.049
8. Synthetic textiles	-0.895	0.048	-0.858	-0.856	0.050	0.137

from the reduction in food subsidy[7].

3. Whenever the ration price is hiked, the food stocks, instead of falling, are increasing. Reduction in stocks is achieved, although to a much lesser extent than what was desired, by distributing through the PDS. Open market sales of foodgrains is possible only in Scheme VI.

4. The movement of real national income (real GDPFC) is strikingly similar to the reduction of food stocks. In other words, holding up stocks affects national income adversely!

5. There is a strong correlation between growth and inflation.

6. The income inequality (as given by the Gini ratios) in rural areas is negatively correlated to growth and inflation. For urban areas also there is a correlation between Gini ratio and growth and inflation, but it is positive.

The first of the above results is interesting, especially in the context of the Indian government's current policy of following up every hike in procurement prices (which are also the support prices in the case of cereals) with an upward revision in the ration prices of foodgrains. Here we consistently observe that a rise in the ration price is not only counter-productive as a tool for reducing food subsidy, it also hampers growth of national income.

The rationale behind such a policy probably lies in the

[7] For the results presented here, we have used $\theta = 1$. If we use a different value for θ, the reduction in food subsidies and that in the budget deficit will be different. The other variables will not be affected. If we use $\theta = .3$, for example, in Scheme II in Situation I, the reduction in food subsidies will be 16.58 crores of rupees, and the reduction in the budget deficit will be -73.46 crores of rupees (see Table 1, items 1 and 2). Note that even the direction of change of the food subsidies is different from that of the budget deficit for this value of θ.

preoccupation of the policy makers with the first round effects. A hike in the ration price of foodgrains will immediately result in an increased revenue from the sales through the PDS. This is reflected in Table 1 as what we call RR. But it is important to observe here that food subsidy is not only for the consumers, it is also for the producers. We observe from the table that RS - which reflects the reduction in subsidy to the producers - is negative, implying that the subsidy on this account actually goes up, and it goes up much more than the decrease in the subsidy on the consumers' account. The net effect is an increase in the overall food subsidy.

Why does the subsidy to the producers increase? An increase in the ration price of foodgrains leads to a decrease in the consumer's disposable income. The household demand for foodgrains is affected adversely causing the free market price of foodgrains to decrease. When the minimum support price is high, the free market price may reach this floor. Given its policy of support prices, the government will then buy more foodgrains in the open market, thus incurring extra expenditures that will add to the food subsidy. In Scheme I, it can be observed that the government has to buy 2.591 million tonnes of additional grains for support price operations. It is easy to see that the higher the level of the support prices, the greater will be the subsidy on the producer's account. It will be more so when there is an increase in the ration prices.

It is clear from above that the success of a policy initiative to reduce food subsidy crucially depends upon how, and how much, the demand for foodgrains is affected. That is precisely what is observed from the results of Schemes II, V and VI. Under Schemes II and V, the quantity supplied through ration shops, Q, is increased by 1 million tonne. The ration price is unaltered. If the overall demand for foodgrains remains unchanged, that would imply a fall in the free market demand by 1 million tonne, and the government has to buy this amount in accordance with its support price policy. However, an increase in Q will lead to an increase in the household disposable income and, therefore, to an increase in the overall demand for foodgrains. If this increase in the overall demand is equal to 1 million tonne, the food stocks will go down by the same amount and the food subsidy, overall, will decrease. If, on the other hand, the increase in the overall demand (say δ) is less than 1 million tonne - it must be due to a fall in the free market demand (by $1 - \delta$) - it is difficult to say a priori how the food subsidy will change. In Schemes II and V we observe that the net effect is an increase in the total subsidy. In Scheme II the government gets additional revenue of 62.49 crores of rupees by selling 1 million tonne of foodgrains in the ration shops; but spends 153.05 crores of rupees for buying (1 - 0.034) million tonnes at the support prices, for imparting price support to the farmers.

The results from Scheme VI stand out from the rest. This isthe only scheme under which food subsidy is actually reduced. Notice also that even the food stocks are reduced (by 0.068 million tonnes), and that too through open market sales. The explanations are not far to seek: When the price of fertilizer is increased by 1 percent, there is a cost-push inflation in all sectors of the economy including the foodgrains. Since wages are indexed to the rise in food prices, there is an all round increase in money wages. The disposable income of the household in nominal terms goes up leading to an increase in the demand for goods and services including foodgrains[8]. The government is thus able to sell some additional quantity of foodgrains in the open market. The results of this scheme underscore the point that the demand for foodgrains must be stimulated for a reduction in the food subsidy.

From Table 2, it can be seen that the sectoral composition of output and prices are significantly altered in each of the schemes. As a result the composition of government expenditure and revenue has changed considerably. Given that, the discrepancy between the reduction in food subsidy and the reduction in the budget deficit is easily explained. But that raises an important question: What is a good measure of a reduction in food subsidy? If the government's objective is to mobilise resources by changing its food policies, its focus ought to be on the budget deficit rather than the sectoral surplus or deficit.

As regards national income, we notice that it is affected adversely whenever ration price is increased, but favourably when ration quantity is increased. As we noted earlier, the food subsidy to the consumers and hence their disposable income is affected adversely in the first case and favourably in the second case. A

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[8] See also the previous chapter on implications of administered price hike.

decrease in disposable income sets off daflationary pressures and ultimately results in a decrease in the real national income. An increase thereof, however, induces inflationary tendencies to which the output of the sectors having excess capacity respond favourably. It can be seen from Table 2, for example, that under Scheme II, the outputs of all sectors (except foodgrains) go up, leading to an increase in national income. Increase in national income in Scheme VI is obvious. But, unlike Scheme II, outputs of all sectors do not increase in Schemes V and VI. The output of construction (and hence the investment in the economy) decreases in these schemes owing mainly to the increase in the prices of basic and intermediate goods. The latter increase as a result of the hike in the price of fertilizer. But the increase in the output of other sectors outweigh the decline in the output of the construction sector so that there is an increase in the national income ultimately.

Inasmuch as growth of national income is a result of demand pull pressures, it ought to be related to inflation in a positive fashion.

The results on income distribution are similar to those in the previous chapter (section 4).

Situation II : When Support Prices Are Low

In this section we study six identical schemes in a situation where the minimum support prices of foodgrains are about 20 percent lower than the prevailing market prices. In other words, here we allow the market prices to decrease to the extent of 20 percent of their base level before the government starts its support operations. The results are given in Table 3.

Notice that there is a positive reduction in food subsidy in all the schemes. This is to be expected since the government is able to reduce its food stocks by the desired amount. The budget deficit decreases more than the food subsidy. The market price of foodgrains also decreases.

It is interesting to note that output of all sectors except consumer durables are affected favourably by a fall in the food prices. The growth of national income, compared to situation I, is higher in all the schemes. Thus, our results suggest that stepping up the food subsidies to keep the consumer's price of food low will stimulate growth. These results also lend support to the findings of many studies in the past which emphasized the importance of foodgrains in a developing economy (Krishnan (1964), Patnaik (1972), Janvry and Subbarao (1986), Narayana et al. (1987)).

A point that needs to be explained is the direct relation between prices of foodgrains and the demand for consumer durables. Inflation certainly benefits some group. When food prices rise, the group which demands mass consumption goods like textiles and other consumer non-durables is affected. Hence the group consuming durables appears to benefit from the increase in food prices. The converse also holds true. The demand for consumer durables in our model is a function of the ratio of household consumption expenditure and the price of consumer non-durables (and, of course, its own price). The price of consumer non-durables increases faster than the expenditure when food prices decrease so that the demand for the durables tends to go down. The supply

TABLE 3

REDUCING FOOD SUBSIDY WHEN PROCUREMENT PRICES ARE LOW: MACRO-VARIABLES

Variable	Scheme I	Scheme II	Scheme III	Scheme IV	Scheme V	Scheme VI
Redn. in Food Subsidy in Rs. Crores(i+ii+iii)	93.13	62.49	161.88	173.05	73.73	164.08
i. RR#	93.13	62.49	161.88	161.87	62.49	0.00
ii. RS#	0.00	0.00	0.00	0.00	0.00	152.83
iii. RF#	0.00	0.00	0.00	11.18	11.24	11.25
Redn. in Deficit in Rs. Crores	252.87	77.17	340.57	348.01	84.71	259.84
Redn. in Food Stocks in Million Tonnes	0.000	1.000	1.000	1.000	1.000	1.000
Change in GDPFC# (%)	0.778	1.348	2.059	2.060	1.349	1.375
Inflation (%)	0.351	0.728	1.054	1.059	0.733	0.795
Change in Gini Coefficient - Rural (%)	-0.032	-0.034	-0.062	-0.062	-0.034	-0.041
Change in Gini Coefficient - Urban (%)	0.038	0.082	0.117	0.118	0.083	0.096
Change in the Price of Food Grains (%)	-10.034	-3.668	-13.330	-13.330	-3.662	-3.523

RR : Additional revenue that accrues from the ration shops.
RS : Additional revenue accruing from the release of stocks in the open market.
RF : Additional revenue accruing from the hike in fertilizer price.
GDPFC : Gross domestic product at factor cost at constant prices.

curve for the durables remains ralatively stable whereas the demand curve shifts down. The new equilibrium is obtained at a point where both the price and the output of consumer durables are lower than the original point. Whenever the price of consumer non-durables goes up faster than the disposable income, the households would curtail the demand for durables rather than reduce their consumption of non-durables. Thus, the preferences of consumers and the possible change in income distribution due to the fall in food prices explain the decline in the output of consumer durables.

4. Conclusion

It is clear from our results that for analysing such important policies as food subsidies, it is desirable to have ageneral equilibrium framework. Policy conclusions derived from a partial equilibrium framework may be misleading.

In many studies in the past, arguments in favour of food subsidies have been based on considerations of equity. It is also argued that such interventions may affect efficiency and growth. But our anlysis demonstrates that food subsidies are desirable not only for equity, but also for promoting growth.

Between the two situations examined above, Situation I seems to be a more meaningful reflection of the current Indian economy than Situation II. The piling up of stocks over and above the needs of the PDS and 'buffer' requirements is an indication of demand constrained conditions, and is difficult to explain unless the floor on the market prices is operative[9]. In other words, in the prevailing conditions, the market price being close to the support price is economically more meaningful.

One weakness of this study is that in the absence of a supply function for foodgrains, our exercises ignore the effect of different policies on the production of foodgrains. We attempted to estimate a supply function for foodgrains using flexible functional forms and specifications. But we did not succeed in obtaining meaningful coefficients. However, most of our results are reinforced when supply functions (disaggregated cropwise) are introduced (see Srinivasan (1987)). It is likely, therefore, that our results will remain unaffected when the supply of foodgrains is endogenised.

Given the government's objective to maintain, if not increase, the food supply, food subsidy can be reduced only by an increase in the demand for foodgrains. To quote from the Economic Survey 1986-87 (Government of India): "The fact that our food stocks are well in excess of desired levels for buffer stocking and food security in a bad monsoon year - and that too, following two below normal monsoons - suggests that a good monsoon could exacerbate the economic and financial costs of high food stocks, unless measures are vigorously pursued to step up utilization of food in antipoverty programmes". The point is well taken.

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[9] Many studies recongnize that food production in India has expanded reasonably rapidly (at about 3 percent per annum) in recent years, but growth of effective demand for food has been slow (Mellor (1988, p 60)). Although 1987-88 was a drought year for India, the preceding two years were demand constrained years, going by the statistics on food stocks in the government godowns. This is also reflected in the quotation from the Economic Survey presented in the concluding paragraph below.

Chapter 5

A PLANNING MODEL

Although the assumption that capital stock is given and sector specific because of underdeveloped capital markets is commonplace in the CGE literature pertaining to developing countries (e.g., Dervis et al. (1982), McMahon (1989)), one could argue that this is primarily a short-term phenomenon. If the discrepancies in the sectoral return to capital were wide enough and persistent, the barriers to mobility could be overcome (Devarajan and Offerdal (1989)). Even in the public sector which does not operate on profit motives, sectors with persistent excess demand would attract investment. Although capital mobility would not be perfect as in industrialized countries (Johansen (1974), Dixon et al. (1977), or Shoven and Whalley (1984)), a certain degree of mobility can be expected.

The CGE model we discussed in Chapter 2 assumed that capital stock in the public sector was given and sector specific and was being fully utilized so that the output of administered goods were exogenously given. It was also implicitly assumed that the private sector had enough excess capacity to make supplies respond to price signals in the same period itself. But at the same time capital formation in construction and plant and equipment was determined endogenously and seemingly did not play any role in the simulation exercises of Chapters 3 and 4.

In this chapter, we have tried to explicitly link up the investment and outputs and use the resultant dynamic model for a few medium-term policy simulations[1]. We call the dynamic version a planning model.

We start by closing the investment output link through the use of incremental capital-output ratios, assuming a simplistic lag structure of one period between investment and output. Thus the next section is devoted to the description of the dynamic model. In Section 3 we present a few simulation results and conclude with the discussion of a maximal scheme (policy package).

2. The Dynamic Model

In the beginning (period 0), the model is essentially the same as the static version described in Chapter 2. The values of exogenous variables such as public investment, supply of foodgrains and tax coefficients etc. are given in this period, but are assumed to grow at exogenously given rates (computed from observed data) from period to period. The supplies of administered goods are also given in period 0; but they are endogenised from period 1 onwards by linking them to the investment in the economy. The concept of equilibrium and adjustment mechanism etc. remain unchanged.

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1 Recall that the simulations reported in earlier chapters were carried out using observed values of exogenous variables and coefficients (like public investment, supply of foodgrains and administered goods , tax coefficients etc.) corresponding to the year 1980-81. In the context of the present chapter, those results could be interpreted as short-term results.

2.1 Investment-Output Link

We assume that there is a one period lag in production in all sectors of the economy[2]. The relation between investment and output is specified as follows:

$$VO_{it} = VO_{i(t-1)} + \frac{I_{i(t-1)}}{ICOR_i}, \qquad i = 1,....,17 \qquad (1)$$

where VO_{it} is value of output of sector i in period t, $I_{i(t-1)}$ is the investment in in period t-1 and $ICOR_i$ is the incremental capital-output ratio. The ICORs are assumed to remain constant over the simulation period[3].

Equation (1) would imply that investment in the non-administered and administered blocks in period t, denoted by $FININV_t$ and $ADMINV_t$

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[2] This lag structure is highly simplistic. Even then it is a weaker assumption than that of instantaneous production used in most of the existing CGE models (e.g., Shoven and Whalley (1984), McMahon (1989)). Narayana et al. (1987) also assume a lag of one period. Longer lags or sector specific lags could not be incorporated due to computer limitations.

[3] The investment-output link here is somewhat similar to that of the Sixth Five Year Plan of India. In fact, the ICORs are taken from the Technical Note to the Sixth Plan (Government of India (1981, Table A1.4)). These ratios were estimated by regressing gross investment at market prices on GDP at factor cost without any lags. Since we are using value of output rather than value added in equation (1), corrections were made by multiplying the ICOR by the value added coefficient of the concerned sector.

respectively, are[1]:

$$FININV_{(t-1)} = \sum_{f=1}^{8} ICOR_f \left[VO_{ft} - VO_{f(t-1)}\right] \quad (2)$$

$$ADMINV_{(t-1)} = \sum_{a=1}^{9} I_{a(t-1)} = \sum_{a=1}^{9} ICOR_a \left[VO_{at} - VO_{a(t-1)}\right] \quad (3)$$

where $I_{a(t-1)}$ is the investment going into a'th administered sector in period t-1.

Also, the two must add up to the total investment in the economy (GDCF), i.e.,

$$GDCF_{(t-1)} = ADMINV_{(t-1)} + FININV_{(t-1)} \quad (4)$$

where $GDCF_{(t-1)} = S_{c(t-1)}(.)p_{c(t-1)} + S_{pe(t-1)}(.)p_{pe(t-1)}$ (see equation (5) of Chapter 2).

Since all the variables relating to period t-1 are known in period t, the investment going into administered sectors would be determined as soon as the value of output of non-administered goods in period t is known (equations (2) and (4)). The value of output of administered goods in period t can be determined from equation (3), provided the allocation of investment to each of these sectors in

[1] Since supply and demand for the non-administered sectors are econometrically estimated, a question arises whether these equations can be treated as short run (period-to-period) equations which is implied by the use of ICORs here. We assume these equations to represent a particular year by using values of the exogenous variables observed in that year (e.g., our base simulation corresponds to 1980-81). Note that 1980-81 is the terminal year of the sample period used for estimation of equations. Our simulations in this chapter will be concerned with periods after that, by using exogenously given annual growth rates for the exogenous variables (computed from actual data). In that sense, we will be doing a forecast for each year of the post-sample period for five years.

period t-1 is known.

We assume that the investment allocation rule in the administered sectors is designed to meet the final demand in the non-administered sectors in the next period[5]. Since the final demand for administered goods is small, the presumption is that it is not important to take it into account while allocating investment in the present period. (This implies that any mismatch between supply and demand for final consumption purposes has to be met through imports.) According to this rule,

$$I_{a(t-1)} = \omega_{a(t-1)} ADMINV_{a(t-1)} \qquad (5)$$

$$\omega_{a(t-1)} = \frac{DD_{at}}{\Sigma_a DD_{at}} \qquad (6)$$

where $\omega_{a(t-1)}$ denotes the the share of $ADMINV_{a(t-1)}$ to be allocated to a'th administered sector in period t-1 and DD_{at} the derived demand obtained as follows:

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5 This rule is similar to the one implicit in the consistency framework adopted in Indian plans (Government of India (1981)). Obviously there is flexibility in choosing such a rule. For example, in another version of the present model (Pradhan et al. (forthcoming)) the following rule was assumed: (i) Public sector production is characterized by a one period lag, while private production was instantaneous; and (ii) all public investment was allocated in the administered sectors according to the pattern of *excess* demand in these sectors in the *current* period, while private investment was in the final and part of the capital goods sector, responding implicitly to price signals. In contrast, in Narayana et al. (1987), total investment is split between agriculture and non-agriculture according to the relative terms of trade.

$$DD_t = (I - A)^{-1}D_t \qquad (7)$$

where DD_t is a 17×1 vector of derived demand for *all* goods, I is 17×17 identity matrix, A the 17×17 input output coefficients matrix and D_t is the 17×1 vector of final demand. Note that the first 8 elements of D_t correspond to the final demand of non-administered goods and the rest 9 elements corresponding to administered goods are zero. Therefore, the last 9 elements of DD_t correspond to the derived demand for administered goods, DD_{at}, used in equation (6) above.

2.2 A Modified Demand Function for Foodgrains

The model described in Chapter 2 is based on an aggregate demand function for foodgrains. In the dynamic version of the model, we have replaced this equation by income group specific demand functions taken from Srinivasan (1987). There are ten food demand functions corresponding to the ten income groups (five each in urban and rural areas) of the model. Each equation is calibrated as a function of own price and disposable income of the concerned income group using elasticities estimated by Murty and Radhakrishna (1981)[1].

2.3 Solution of the Model

In period 0, the solution procedure remains the same as described in Chapter 2. Given the values of exogenous variables, we start with

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[1] The price and income elasticities are as follows:

Income Groups	Rural					Urban				
	1	2	3	4	5	6	7	8	9	10
Price	-.92	-.78	-.55	-.21	-.33	-.89	-.73	-.36	-.15	-.18
Income	.97	.90	.77	.44	.32	.96	.75	.49	.14	.15

some arbitrary prices of final and capital goods. Administered prices are computed using cost equations. Investment and incomes are computed using estimated equations of final and capital goods, and exogenously given supplies of intermediate goods. Income distribution is computed using a value added coefficients matrix. Demand for non-administered goods are computed using estimated equations and that for administered goods using input output coefficients. Demand and supplies are now confronted and the arbitrarily chosen starting prices are revised for equilibrating the non-administered markets, whereas imports are resorted to for equilibrating the administered block. Credit market is cleared through quantity adjustment, and if need be, through rationing of bank credit to the private sector.

Once investment is linked to output of the next period, the computation of solution becomes complicated. Traders' expectations will have to be specified for computing the allocation of investment. Even if one assumes perfect foresight on the part of traders, income generation in the current period will be affected by the investment pattern which, in turn, will be determined by demand pattern in the next period. The endogenous variables in each period, therefore, will become inextricably interlinked and it will be necessary to solve the model simultaneously for all future periods.

To simplify computations, we make two simplifying assumptions. (i) The investors have perfect foresight so that their expected demand pattern is fully realized in the next period. (ii) Since we do not have a capital coefficients matrix, the investment by destination is implicitly captured by the estimated equations for construction and plant and equipment. We assume that the income generated in the current period by all investments in the economy are reflected in the value added from construction and plant and equipment (obtained by multiplying value added coefficients to the value of output).

The second assumption is very strong, because it implies that different investment allocation rules do not generate different incomes in the current period. In other words, the solution of the model in the current period becomes independent of the next period.

In period 1, the exogenous variables are revised using assumed growth rates. Starting with arbitrary prices (and also incomes), we determine the demand for and supply of non-administered goods and then the derived demand for administered goods. Total investment and its distribution between non-administered and administered sectors are then obtained using equations (2) and (4). The derived demands are used for computing the weights according to which investment (ADMINV) would have been allocated in the last period in different administered sectors (equations (5), (6) and (7)). The value of output of administered goods in period 1 are now determined using equation (3). By now values of output in all sectors are known. Using value added coefficients, national income and income distribution are computed. These values (of income and income distribution) may not match the ones assumed in the beginning. So we iterate on them (as well as prices) till a fixed point is found. The same procedure is repeated for all subsequent periods.

In all simulations, we solve the model for five periods. For convenience, we call each simulation a 'plan'.

3. Some Applications of the Model

In this section we apply the dynamic model to examine a few policy questions such as the implications of stepping up public investment, the effects of raising administered prices and interest rate, the problem of taxation vs. licensing and so on. While evaluating simulation results, we will generally compare real national income, inflation, income distribution and trade deficit across different schemes. We noticed that the Gini ratio, which is computed in our model from five income groups each in rural and urban areas, is not very sensitive to small changes in policy instruments. For inferences regarding income distribution, therefore, we will use some broad indicators such as the share of wages in disposable income, price and availability of mass consumption goods (foodgrains, cotton textiles and consumer non-durables) as compared to that of luxury goods (synthetic textiles and consumer durables). Sometimes, however, it may become difficult to interpret results unequivocally (when, for example, national income and trade deficit are both higher in one simulation than in another).

Unless otherwise stated, we will retain the various rates (e.g. tax rates) used in the static model and assume that they remain invariant over the simulation period. The growth rates assumed for exogenous variables are presented in Table 2. These rates are computed from actual data over the period 1980-81 to 1985-86. Since

TABLE 2 : COMPOUND GROWTH RATES FOR EXOGENOUS VARIABLES USED IN THE PLANNING MODEL

Variable	growth rate(%)	Variable	Growth rate(%)
GCE_{70}	9.73	P_{CHM}	5.35
$GE_{exo\ 70}$	7.00	P_{CY}	3.77
$GR_{exo\ 70}$	7.00	P_{SY}	3.90
$INFR_{70}$	2.60	RTNP	5.06
INVTR	9.49	RTNQ	3.15
PBI_{70}	14.00	S_{FG}	3.04

TABLE 3 : INCREMENTAL CAPITAL-OUTPUT RATIOS (ICOR) USED IN THE PLANNING MODEL

SECTOR(S)	ICOR*
FG, IR	3.7102
CNDNT, CD, PE, TC, TS, ISF-A, ISC-F, FERT & CEMENT	5.1602
C	0.9338
SE	8.2887
COAL, PETROL	4.6664
POWER	25.3028
BIG	4.1772

Source : Technical Note to the Sixth Plan, Table A1.4

* Since our sector classification and those given in the Technical Note do not always match, we make some assumptions such as that FG and IR have the same ICOR as 'Agriculture' and so on.

the five periods of our simulations more or less coincide with the Sixth Five Year Plan of India (1980-85), we will use certain data that were used therein. The incremental capital-output ratios in particular have been taken from Table A1.4 of the Technical Note to the Sixth Plan (Government of India (1981)). They are presented here in Table 3. The important results of the simulations are summarized in Tables 4.a and 4.b (to be together referred to as Table 4).

3.1 The Base Simulation

Assuming status quo (i.e., no change in policy), the model could not run beyond the third period because first the price of cotton textiles (TC), next the price of synthetic textiles (TS) and then that of services (SE) hit the upper bounds, implying tremendous growth in demand. In the next few runs, we tried to accelerate the supply of cotton textiles by giving price subsidy to the producers[6]. At 30 per cent subsidy (as opposed to 5 per cent tax in the status quo) the supply of cotton textiles increased sufficiently to match the demand and the prices were well within the bounds. The prices of synthetics and services also behaved well. The results of this scheme are summarized in Table 4 as *Scheme 2*. It is interesting to note the closeness of these growth rates with the observed growth rates: the

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[6] Price subsidy is incorporated in the model by modifying the price term in the supply equation of cotton textiles. If price was p earlier, it is now written as p(1+s) where s is the rate of subsidy.

TABLE 4.a : EFFECTS OF SOME ECONOMIC POLICIES ON MACRO-VARIABLES

(Compound rate of growth over five years)

SCHEME*	GDPMP R	GPI	GDCF R	M3	IMPORTS (Rs crores)
1. Base	5.16	9.4	8.6	18.4	20900
2. Base, PBI R 5%	4.6	8.6	5.6	15.5	21628
3. Base, WI 10%	6.18	12.05	8.5	20.6	23941
<u>Administered Price Policy</u>					
4. Adm. Pr. 5%	3.78	7.24	7.3	17.15	26482
5. Adm. Pr. 5%, WI 10%	3.93	7.78	7.3	17.69	25421
<u>Interest Rate Policy</u>					
6. SNWY 5%	5.61	10.26	8.9	19.00	20751
7. SNWY 5%, -->GR	5.15	9.46	8.6	18.48	20401
<u>Licensing</u>					
8. Base, WI 10%, Lic. CD,TS	6.17	12.51	8.9	20.96	15609
9. Adm. Pr. 5%, Lic. CD,TS	6.15	12.51	8.9	20.99	15598
<u>Taxation vs Licensing</u>					
10.SNWY 5%, Lic. CD,TS	5.63	10.71	9.0	18.80	15253
11.SNWY 5%, CD 400% Tax	5.64	10.70	8.9	18.97	16166
<u>A Maximal Scheme</u>					
12.SNWY 5%, WI 10%, Lic. CD,TS	6.33	12.78	9.0	21.40	15550

PBI R 5% : Public investment in real terms increased by 5 %
WI 10% : Wages indexed to food prices by 10 %
Adm. Pr. 5% : Administered prices increased by 5 %
SNWY 5% : Share of non-wage income increased by 5 %
-->GR : Increase in non-wage income taxed away
Lic. CD,TS : CD and TS licensed to grow at a maximum rate of 5 %
CD 400% Tax : Tax on CD increased by 400 %

* In all the schemes there is 30 % producer subsidy on cotton textiles and PBI R is increasing at 14 % per annum except in Scheme 2.

TABLE 4.b : EFFECTS OF SOME ECONOMIC POLICIES ON FOOD PRICE AND SECTORAL OUTPUT

(Compound rate of growth over five years)

SCHEME*	FOOD PRICE	TC	CNDNT	TS	CD	C	PE	SE
1. Base	13.0	5.6	5.9	17.4	14.9	8.1	11.9	3.9
2. Base, PBI R 5%	9.3	4.9	6.7	15.6	13.0	6.5	6.6	3.8
3. Base, WI 10%	17.4	7.8	4.3	22.9	20.7	8.5	17.9	4.8
<u>Administered Price Policy</u>								
4. Adm. Pr. 5%	1.7	3.6	8.0	12.0	8.6	5.8	12.1	3.1
5. Adm. Pr. 5%, WI 10%	4.2	4.1	7.7	13.2	9.9	6.1	12.1	3.4
<u>Interest Rate Policy</u>								
6. SNWY 5%	16.9	6.3	4.9	19.4	17.2	8.5	11.8	4.2
7. SNWY 5%, -->GR	12.9	5.6	5.9	17.4	14.8	7.9	11.9	4.0
<u>Licensing</u>								
8. Base, WI 10%, Lic. CD,TS	27.9	8.1	2.3	5.0	5.0	9.4	11.4	4.9
9. Adm. Pr. 5%, Lic. CD,TS	27.9	8.1	2.3	5.0	5.0	9.3	11.3	4.9
<u>Taxation vs Licensing</u>								
10.SNWY 5%, Lic. CD,TS	18.7	7.2	4.2	5.0	5.0	8.5	11.6	4.2
11.SNWY 5%, CD 400% Tax	16.1	6.7	4.9	5.0	5.0	10.7	11.7	4.2
<u>A Maximal Scheme</u>								
12.SNWY 5%, WI 10%, Lic. CD,TS	21.2	8.2	2.5	5.0	5.0	9.5	11.5	5.1

PBI R 5% : Public investment in real terms increased by 5 %
WI 10% : Wages indexed to food prices by 10 %
Adm. Pr. 5% : Administered prices increased by 5 %
SNWY 5% : Share of non-wage income increased by 5 %
-->GR : Increase in non-wage income taxed away
Lic. CD,TS : CD and TS licensed to grow at a maximum rate of 5 %
CD 400% Tax : Tax on CD increased by 400 %

* In all the schemes there is 30 % producer subsidy on cotton textiles and PBI R is increasing at 14 % except in Scheme 2.

computed (annual compound) rates of growth of national income, inflation and money supply (M3) are 4.6, 8.6 and 15.5 percent respectively, whereas the corresponding observed rates were 4.96 8.72 and 16.3 percent respectively. Note that in this scheme public investment in constant prices (PBI R) is increasing at 5 percent per annum.

In the next scheme, we increased the rate of growth of public investment to 14 per cent, retaining the 30 per cent producer subsidy on cotton textiles. The results are presented in Table 4 as *Scheme 1*. Compared to Scheme 2, most of the macro-variables grow faster in this scheme. Notice that the output of consumer non-durables (CNDNT) has gone down. The reason can be traced to a demand side problem, arising out of the faster rise in the price of foodgrains (The link between non-durables and foodgrains (FG) has been discussed in Chapter 3).

We will call this scheme the *Base Scheme*. All subsequent simulations will be based on and compared to this scheme where supply of foodgrains is increasing at 3 per cent, public investment in real terms is growing at 14 per cent and there is 30 per cent subsidy on cotton textiles.

In *Scheme 3*, we combine the base scheme (i.e. Scheme 1) with 10 per cent indexation of wages with respect to the price of foodgrains over a benchmark price[7]. The demand for foodgrains is not enough till

[7] With 25 percent indexation, the system does not converge to an equilibrium in the fifth period. So we use 10 percent indexation.

the second period so that price of foodgrains does not go above the benchmark price. Only in the third period does demand pick up to push the food prices above the benchmark level. Once that happens, wage-spiral gets started. In the fifth period, the economy settles down to a point where the annual rate of growth of national income is 6.18 per cent and annual inflation, 12.05 per cent. Food prices have grown at a rate of 20.6 per cent, causing the growth rate of non-durables to go down further. Therefore, although output of cotton textiles has gone up, we cannot say anything definite about the lot of the poorer sections. However, we do notice that with wage-indexation, outputs of consumer durables (CD) and synthetic textiles (TS) have gone up considerably.

3.2 Administered Price Policy

In the next two schemes we examine the effects of simultaneously raising the prices of *all* nine administered goods by 5 per cent each (i) when wages are not indexed and (ii) when wages are indexed by 10 percent[a]. The results are presented in Table 4 as *Scheme 4* and *Scheme 5* respectively. Compared with the base scheme, the growth rates of most macro-variables are significantly lower in these schemes. In Scheme 5, until the fifth period the demand for food does not pick up

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[a] The exact procedure of raising administered prices and indexing wage to food prices are discussed in details in Chapter 3.

so that wage indexation is rendered ineffective. Here again the inverse relation between the output of non-durables and price of foodgrains is noticeable.

Why does the growth rate (of national income) go down when administered prices are increased? The reason is that when prices of administered goods go up, supply of investment goods tends to come down. Compared to the base scheme, therefore, investment, and hence output over the whole plan period, is less. These results should be compared to those obtained in the static version of the model (Chapter 3, Sections 3.2 and 3.3). There we found that in the short run, raising administered prices resulted in a positive growth, though investment generally decreased or marginally increased. The decline of investment is fully reflected in the present results through a decline in growth rate of income.

The result of this scheme broadly conform to the dominant view in India that prices of intermediate goods should be kept low in order to promote growth. To quote Prof. P.C. Mahalanobis, the architect of India's Second Plan, "For rapid industrialization of an under-developed country it would be desirable to keep the cost of capital goods as low as possible. The further removed the type of capital goods under consideration from the final consumer goods, the greater is the need of keeping the price low" (Mahalanobis (1955)).

But as it was pointed out in the conclusion to Chapter 3, these results ought to be judged after duly emphasizing the conditions that drive them. As we will notice soon in subsection 3.4, administered price hike with wage indexation (i.e., Scheme 5) combined with a licensing policy on durables and synthetic textiles would lead to a growth rate of national income of 6.15 per cent (See Table 4 against Scheme 9).

3.3 *Interest Rate Policy*

In our model interest rate does not figure explicitly in any equation and to that extent, it is difficult to simulate an interest rate policy. Notice, however, that the the interest rate is implicit in the value added coefficients:

$$V = k \frac{r}{\bar{r}} + l \frac{w}{\bar{w}} \qquad (8)$$

where V is the value-added coefficient (per unit of output) for any sector, k is the capital coefficient, r and w the current rates of interest and wages respectively, l is labour coefficient, and $\bar{r}$ and $\bar{w}$ are respectively the rate of interest and wages in the base period[9].

If the rate of interest goes up by, say, 1 per cent, the new value-added coefficient will be,

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[9] In this equation, r is the rental rate on capital which will equal the rate of interest when there is competition in the capital market. In any case, variations in (administered) rate of interest would produce similar variations in the rate of return on non-labour primary factors of production. Hence, we would refer to r here as the rate of interest.

$$V^1 = k\,\frac{r(1+.01)}{\bar{r}} + l\,\frac{w}{\bar{w}} \qquad (9)$$

Thus, if equation (8) is written as V = K + L where $K = k\frac{r}{\bar{r}}$ is non-wage income and $L = l\frac{w}{\bar{w}}$ is wage income, $V^1 = K^1 + L$ where $K^1 = K(1 + .01)$, non-wage income after the rise in interest rate. An increase in r thus produces an equivalent increase in the non-wage income per unit of output (NWY).

An increase in the rate of interest, like an administered price increase, will be accompanied by a price effect whereby costs will tend to rise, and also an income effect whereby the interest income will go up[10]. Clearly, these two effects will influence the demand vector in opposite directions.

We examine two schemes in this subsection:

Scheme 6 : Interest rate is raised by 5 percent.

Scheme 7 : Interest rate is raised by 5 per cent, but the additional non-wage income that results is taken away by the government to reduce its budget deficit.

The results are presented in Table 4.

In Scheme 6, the income effect dominates the price effect so that

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10 Note that the interest income thus generated stays within the private sector itself, since the higher interest rate paid by the borrowers accrues to the lenders finally. Banks operate only as financial intermediaries. If they are owned by the government, they do not operate on profit motives so additional income from interest differential, if any, is ploughed back to the private lenders.

national income registers a noticeable increase when compared with the base scheme. Since the additional income from interest hike accrues more to the richer section, investment is higher, reflecting their higher propensity to save. The change in income distribution is also evident from the increase in the demand for synthetic textiles and consumer durables.

When the additional interest income is taken away by the government to reduce its deficit rather than augmenting public investment, the price effect is left to operate with no income effect to oppose it, and the result is a decrease in national income caused by a fall in investment. Another thing to notice here is the closeness of various growth rates between this scheme and the base scheme. It probably reflects that the price (or cost-push) effect of an interest rate hike is not strong enough to induce any significant changes in the economy.

3.4 Licensing of the Luxury Goods

All along we notice that by protecting wages or even by increasing the non-wage income we are able to achieve a higher growth of national income. But so far equity has remained elusive. Even indexation of wages in Scheme 3 did not achieve a better distribution of income. Is it possible to improve equity, without hampering growth, by some strong policy measures?

In the next two schemes we examine this question by introducing a licensing measure for the luxury goods (synthetic textiles and consumer durables) whereby the rate of growth of output in these two sectors is restricted to a maximum of 5 per cent per annum[11]. The presumption is that if the rich want to invest, but cannot do so on luxury goods beyond a limit,. they will have to invest on mass consumption goods such as cotton textiles and consumer non-durables.

The two schemes considered here are:

Scheme 8 : Base scheme combined with 10 per cent wage-indexation and licensing on luxury goods.

Scheme 9 : Administered prices increased by 5 per cent, 10 per cent wage indexation and licensing on synthetic textiles and consumer durables.

Let us first compare the results of Scheme 8 to those of the (comparable) Scheme 3. The figures for national income are surprisingly close to each other. But the output composition is altogether different in Scheme 8. We notice that consumer durables and synthetic textiles are growing at the full permissible capacity, implying existence of excess demand for them. Output of cotton textiles at 8.10 per cent is higher than the comparable figure (7.8

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[11] This is simulated by replacing the estimated supply equations by fixed quantities representing five percent increase over the base period supplies, once supplies exceed the latter. Thus, $S_t = S_t(p, .)$ for $S_t(.) < \bar{S}_t$ and $S_t = \bar{S}_t$ otherwise. S_t is supply and $\bar{S}_t$ is the licensing limit, given by $S_{t-1}(1+.05)$ where S_{t-1} is the equilibrium level of supply in period t-1.

per cent) in Scheme 3. But the biggest difference is noticed in the import bill - under licensing, there is a saving of Rs.8000 crores on account of imports.

The considerable decline in the import bill is due to the fact that luxury goods (i.e.,synthetic textiles and consumer durables) are more import-intensive than essential goods. The foreign exchange that is saved on account of reduced imports can be used to stimulate the demand for consumer non-durables which has fallen owing to the increase in food prices. In fact, this saving can be used to import foodgrains, for example, which will not only contain the food prices, but also augment the demand for (hence output of) consumer non-durables.

These results would lend support to the critics of current liberalization policies of the Indian government - encouraging production of non-essential goods such as electronic items or automobiles, which are highly import-intensive, is a reason for the severe balance of payments problem faced by India.

This is again borne out by the results of Scheme 9. This scheme is comparable to Scheme 5 discussed above. We notice that introduction of licensing leads to a growth rate of 6.15 per cent as against 3.93 per cent in Scheme 5. In addition, there is a saving of about Rs.8000 crores on imports.

3.5 *Taxation vs. Licensing*

There is an ongoing debate on the desirability and effectiveness of licensing as a policy instrument. Often it is said that taxation is as effective as licensing, and since it also contributes to the government fisc, it is more desirable than licensing. While the latter point is agreeable enough, the first point point is an empirical question.

We consider the following schemes:

Scheme 10 : Interest rate is increased by 5 per cent and there is licensing on consumer durables and synthetic textiles such that their supplies do not grow above 5 percent per annum.

Scheme 11 : Interest rate is increased by 5 per cent and there is licensing (of 5 percent) on synthetic textiles, but the excise tax on consumer durables is increased in such a way that supply is restricted to a maximum of 5 percent growth[12].

The results are presented in Table 4. Before comparing the results of these two schemes, it may be mentioned in passing that again the scheme with licensing yields a higher growth rate, emphasizing the results of the earlier subsection.

A comparison between Scheme 10 and Scheme 11 reveals that a 400

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12 This is achieved by making the rate of excise tax on consumer durables endogenous subject to the restrictions on supply. The exact equilibrium rate is found by using the fixed point algorithm.

per cent increase in the excise tax on consumer durables is just about adequate to produce the same effects as licensing (whereby consumer durables are allowed a maximum 5 per cent rate of growth). The current rate of tax on consumer durables is 12.6 per cent advalorem. A 400 per cent increase would imply a tax rate of about 63 per cent ad valorem. This also implies that, if the producers of consumer durables are paying an excise tax of about Rs.400 crores currently, they will have to pay a hefty sum of Rs.8000 crores after five years. The practical feasibility of such a tax policy is rather questionable.

3.6 A Maximal Scheme

Here we try to find a maximal scheme - one that is better than the previous schemes - by choosing from the various simulations described above the policies that promote growth and equity. We have learnt from Scheme 6 that the policy of increasing the interest rate (i.e, non-wage income), taken individually, is the best for growth, while wage indexation seems to promote growth under all circumstances. We have also learnt from the various schemes above that licensing of consumer durables and synthetic textiles promotes equity. In Scheme 12, therefore, we combine these three measures:

Scheme 12 : Interest rate is increased by 5 per cent, there is 10 per cent wage indexation and 5 percent licensing on consumer durables and synthetic textiles.

The results are presented in Tables 4 and 5.

From Table 4, it is evident that this is the best scheme as far as growth is concerned. As to equity, growth of consumer durables and synthetic textiles is restricted while that of cotton textiles is the highest among all the schemes. Import bill is one of the lowest. Real investment is also better than all other schemes. The only shortcoming is regarding the availability of consumer non-durables and the price of foodgrains. But as we mentioned earlier, the saving on imports can be utilized to augment the supply of foodgrains as well as consumer non-durables.

At first sight, the results of this scheme appear quite counter-intuitive : How can a restriction on supply of goods lead to more growth or, for that matter, how can an increase in non-wage income lead to more equitable distribution of goods? The explanation is as follows.

First, the non-wage income is increased (through increase in interest rate) so that the rich become richer. Savings in the economy rises, (i) because the savings propensity of the rich is higher, and (ii) because the rich cannot buy desired quantity of luxury goods due to the licensing in these sectors. Again, the increased savings cannot be invested in luxury goods because of the licensing, so there is a forced investment on other goods such as mass consumption goods. The availability of essential goods, thus, increases. Moreover, since these sectors are also more labour-intensive (as compared to luxury goods), employment increases. That generates more demand for essential goods, giving further incentive to the producers to produce

TABLE 5 : THE MAXIMAL SCHEME : RATES OF GROWTH OF MACRO-VARIABLES

Variable	period 1	period 2	period 3	period 4
1. GDPMP R	3.83	5.94	6.96	8.17
2. GPI	5.37	20.24	10.71	14.20
3. GDPFC R	5.61	7.75	13.68	9.26
4. M3	14.53	30.59	17.96	20.57
5. IMPORTS*	10735	14950	14103	12469
6. FOOD PRICE	0.00	48.00	27.87	42.70
SECTORAL OUTPUT				
7. TC	2.44	12.72	6.98	10.65
8. CNDNT	6.96	3.88	0.73	-
9. TS	9.45	6.56	5.00	5.00
10.CD	6.89	5.07	5.00	5.00
11.C	5.24	14.28	8.24	9.85
12.PE	11.32	12.86	10.64	10.44
13.SE	2.44	7.78	4.15	5.08

* Changes in imports are in Rs crores.

more of these goods. Also the demand for food goes up and after a point the wage-spiral is set off. Ultimately when the economy settles down to equilibrium (in each period), it is already on a higher growth path with more equitable distribution of consumption.

An important question that arises here is: when the non-wage income is increased in the first place, who bears the burden? Notice that in our set-up, the increase in non-wage income comes about through an increase in the rate of interest. The story is that the increase in the cost of production of a good that arises because of a hike in interest rate is passed on to the consumers. Thus, the burden of the interest rate hike falls on the wage income earners. The artificial increase in the interest rate is in essence a device for inducing 'forced saving' from the the earners of wage income. On final count, however, wage earners are better off with higher consumption opportunities.

One must emphasize the crucial role played by licensing in this scheme - without it, there is no certainly that the producers will invest on essential goods.

Another important observation is the positive relation between the growth of national income and inflation. In fact this relation is noticeable in all our schemes.

Table 5 displays the path of some important variables within the simulation period. Notice that it stops in period 4. We do not present here results for the fifth period, because during this period the price of foodgrains hits the upper bound due to tremendous excess demand pressures generated by wage-spirals. This fact is also reflected, as mentioned several times earlier, by the decline in output of consumer non-durables. An important implication of this observation is that food supply must be augmented for the completion of this particular plan (scheme).

An interesting observation from Table 5 is that the relation between the rate of growth and inflation *within* the plan period is not monotonic, unlike the relation between *compound* rates of growth and inflation across different plans. The inter-temporal profile of growth and inflation in the present scheme and the base scheme is plotted in Figure 4. It is also seen from this figure that inflation is more in the initial years than the later years during the plan[13]. That is because, with passage of time, output from old investment starts materializing and supply curves shift to the right.

The maximal scheme, however, is certainly not the 'best' scheme inasmuch as there is always scope to improve upon it. An obvious improvement, as evident from the earlier schemes, could be a decrease in the administered prices as an addition to the present scheme.

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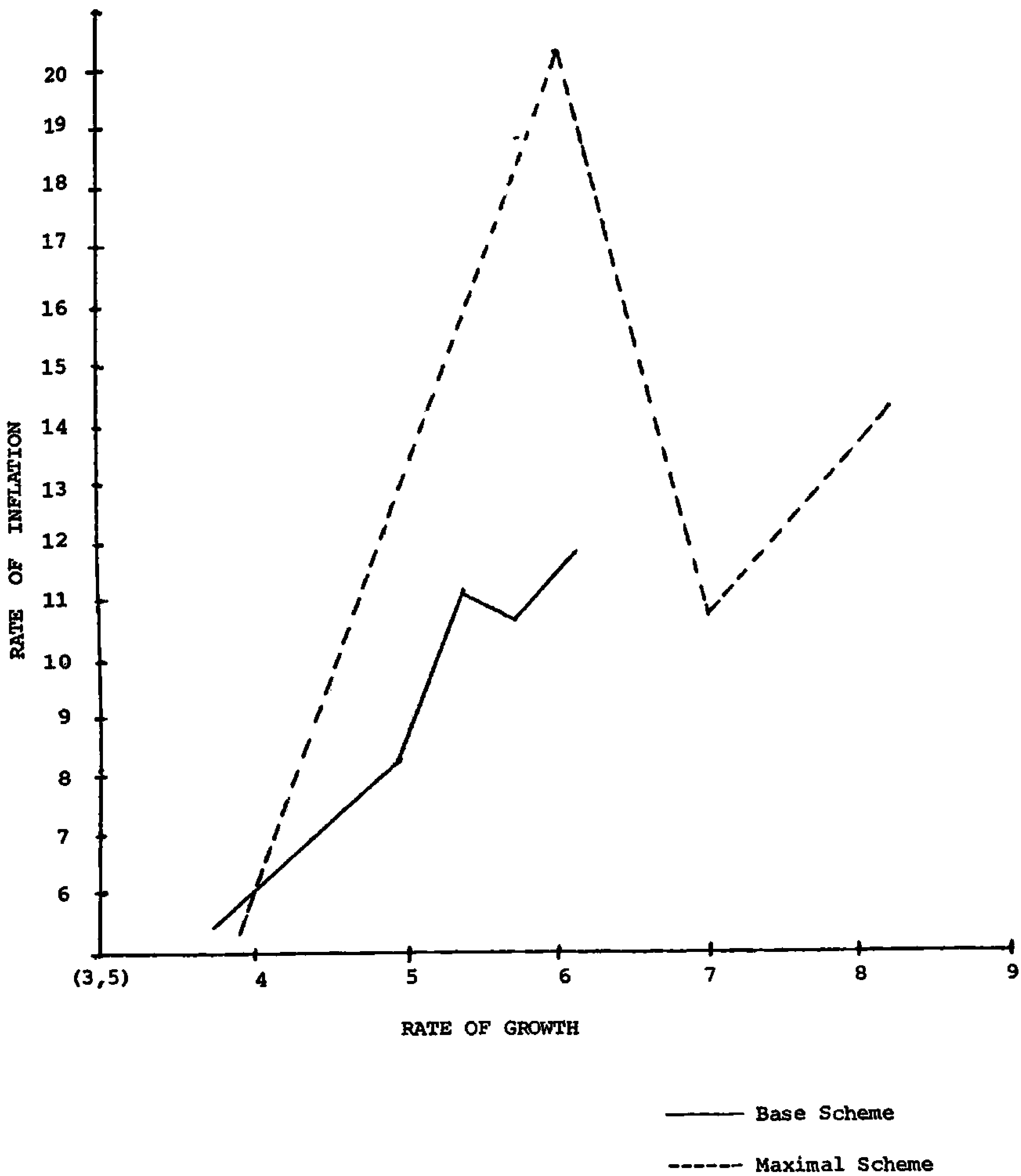
13 Years are represented as kinks in the plotted curves.

FIGURE 4 : GROWTH AND INFLATION DURING A PLAN



Chapter 6

CONCLUSION

In retrospect, the points that were raised in Chapter I regarding the construction of a suitable plan frame have been taken care of - at times in a simplistic fashion, though - in the model that has evolved over the subsequent chapters. The distinguishing features of the model are (i) endogenisation of relative prices (ii) inclusion of money in a way that it matters, and (iii) income generation and distribution as an outcome of the production processes (and not direct transfers from one class to another). Moreover, the model includes explicitly some characteristic features of the government in a developing economy - viz. direct interference by government in production (through public sector enterprises) and distribution (through the public distribution network), in prices (through administered prices) and quantities (through licensing) and so on. This is probably the first economy wide model of India to have all these features within one framework. Not surprisingly, some of the results from this model are quite different from the existing ones.

The broad results that emerge from the simulation exercises described in the earlier chapters are:

1. The consumer prices of foodgrains play an important role, particularly in determining the demand for mass-based consumer goods (such as non-durables). Therefore, they must be stabilized, not only on equity grounds, but also for growth.

2. Left to itself the economy cannot absorb the current rate of growth (= 3 percent) in foodgrains production. Therefore, to sustain the latter, the government must intervene by providing remunerative (support) prices to the farmers. In other words, price subsidy to the farmers is essential. Given its policy of supporting the farmer, the government should not raise the issue prices (the price at which foodgrains are sold in the fair price shops) in order to curtail food subsidy to the consumers; because it may prove self-defeating. Raising issue prices may reduce the overall demand for foodgrains whence the government may have to give more subsidy to the farmers.

3. Cotton textiles has to be subsidized to the extent of 30 per cent ad valorem if its supply is to match the growing demand. That will improve growth as well as equity; because cotton textiles is an essential commodity.

4. Prices of intermediate goods should be kept low to promote growth.

5. Curbing the production (and, hence, consumption) of non-essential goods like consumer durables and synthetic textiles through licensing regulations improves growth and equity and brings down the import bill considerably. In other words, rechannelling investment from non-essential goods to mass-based and more essential goods (like non-durables and cotton textiles) is desirable on all counts

6. A fruitful way of diverting investment to the mass consumption goods is to increase the non-wage income (e.g., through an increase in interest rates), but to restrict the expansion of commodities which

are consumed by the earners of such (non-wage) income. Therefore, a scheme with a 5 per cent rise in interest rates, a licensing restriction on consumer durables and synthetic textiles (allowing a maximum 5 per cent growth) can achieve a 8 percent rate of growth in national income. If to that is added a reduction in the administered prices of intermediate goods, the growth rate may be higher.

The main weaknesses of the model are the absence of income group specific demand functions in some commodity sectors, absence of a proper demand function for money and inadequate modeling of the external sector. We were also hampered by lack of a capital coefficients matrix. Also the estimation of parameters could be greatly improved by adopting suitable econometric techniques.

The model offers a lot of scope for extension. A mechanical extension would be to go in for greater disaggregation for commodities. The financial markets also need expansion, particularly in the direction of introducing portfolio choice for the agents. That would require inclusion of agents' future expectations. Also the lag structure in production could be significantly improved. These areas are still quite under-researched in the existing empirical models.

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APPENDIX O

NOTATIONS

A, a	Administered goods
ADMINV	Investment on administered goods
ARM	Additional resource mobilisation
ATR	Additional transfers by the government
BIG	Basic and intermediate goods
BONDS	Shares and debentures purchased by the household sector
C	Construction
c	Consumption coefficients
CHM	Basic industrial chemicals
CNDNT	Consumer non-durables, non-textiles
CRG	Bank credit to government sector
CRP	Bank credit to the private sector
CY	Cotton yarn
D	Demand
DT	Rate of direct tax on household
DTR	Government revenue from direct taxation of household
DY	Disposable income of household
EXP	Consumption expenditure of household
f	Non-administered goods
FERT	Fertilizers and pesticides
FG	Foodgrains
FININV	Investment on non-administered goods
GCE	Government consumption expenditure on goods

GDCF	Gross domestic capital formation (nominal)
GDCF R	Gross domestic capital formation in real terms
GDPFC	Gross domestic product at factor cost (nominal)
GDPFC R	Gross domestic product at factor cost in real terms
GDPMP	Gross domestic product at market prices (nominal)
GDPMP R	Gross domestic product at market prices in real terms
GE	Government expenditure (nominal)
GE R	Government expenditure (real)
GPI	General price index
GR	Government revenue (nominal)
GR R	Government revenue (real)
I	Investment
ICOR	Incremental capital output ratio
INFR	Infrastructure
INVTR	Food stocks with the government
IR	Industrial raw materials
ISFA	Iron and steel, ferro-alloys
ISCF	Iron and steel, casting and forging
ITR	Government revenue from indirect taxes
NWY	Non-wage income
p	Price index
PBI	Public investment (nominal)
PDS	Public distribution system
PE	Plant and equipment
PERINC	Personal income
PETROL	Crude petroleum and natural gas

PHYSAV	Savings of the household on physical assets
POWER	Electricity
PRI	Private investment
p_r	Ration (issue) price of foodgrains
Q	Ration quota for public distribution of foodgrains
r	Rate of rental (or interest)
S	Supply
SAV	Household savings
SE	Services
SUBCD	Subsidy on public distribution of foodgrains
SY	Synthetic yarn
τ	Rate of excise tax
TC	Cotton textiles
TCD	Cotton textiles in the decentralized sector
TCM	Cotton textiles in the mill sector
TS	Synthetic textiles
TSD	Synthetic textiles in the decentralized sector
TSM	Synthetic textiles in the mill sector
v	Value added coefficient
VAD	Value added in the administered goods block
VO	Value of output at current prices
w	Wage rate
WY	Wage income

APPENDIX I

COMMODITY CLASSIFICATION AND DATA

a. Commodity Classification

Commodities are aggregated into 16 sectors from the 115x115 Commodity × Industry Transactions Table, 1973-74 prepared by the Central Statistical Organisation in the following way[1]:

Sector	Corresponding sector number(s) in the I-O Table
1. ISFA	72
2. ISCF	73
3. COAL	23
4. PETROL	24
5. POWER	100
6. FERT	62, 63
7. CEMENT	70
8. IR	8-17
9. BIG	25-32, 58-61,64, 67-69, 71, 75
10.C	99
11.PE	74, 76-89, 91, 96
12.FG	1-7, 18-22
13.CNDNT	33-40, 51, 52, 65, 66
14.CD	50, 54-57, 92-94, 97, 98
15.SE	53, 90, 95, 101-115
16.TC, TS	41-49

[1] Cotton and synthetic textiles are treated as separate by using separate supply and demand equations for them. So, the number of commodity sectors actually is 17. Only input output coefficients are computed for 16 sectors.

b. Data

Administered Goods

Values of output Supply of administered goods are taken from the *Annual Survey of Industries 1980-81*. For industrial raw materials, value of output is obtained from *National Accounts Statistics* (NAS henceforth).

Prices indices are taken either from various issues of NAS or *Report on Currency and Finance* (RCF henceforth).

Investment Goods

Supply of construction and plant and equipment are estimated using the gross domestic capital formation deflated by their price indices.

Price indices are computed as the gross domestic capital formation in current prices as a percentage of gross domestic capital formation in constant prices.

The source is various issues of NAS.

Final Goods

For foodgrains, supply is taken from *Economic Survey* (ES henceforth). Demand equations are estimated using net availability (= domestic production net imports - stocks), taken from various issues of ES and *Area, Production and Yield of Principal Crops in India*. Price indices are from *Chandhok* (1978).

For consumer non-durables and durables, value of output at constant (1970-71) prices obtained from NAS are used for the estimation of equations. Price indices are from Chandhok (1978).

For services, output is estimated using value added deflated by the price index. Implicit deflators are used for price indices. The source is NAS.

Equations for cotton and synthetic textiles are taken from *Chetty et al. (1986)*. These equations were estimated using Textile Committee's Panel Data, data published in *Man-Made Fibre Statistics* and Chandhok (1978).

Credit

Total credit is defined as the sum of Reserve Bank credit and commercial bank credit to the government and the commercial sectors. Data are obtained from RCF. For the estimation of supply function, financial savings of the household and government deficit figures have been taken from NAS and RCF.

There is a difference between the Central Statistical Organisation and the Reserve Bank of India as to the definition of the public sector. The C.S.O. definition is based on ownership, while the R.B.I. definition is use-based. Thus, according to C.S.O., public sector enterprises are a part of the government sector, whereas, RBI clubs the non-departmental enterprises with the commercial sector. Due care has been taken in this respect because data from both sources are used.

Appendix II

EQUATIONS

A. Supply and Demand

a. Non-Administered Goods

Supply and demand functions are econometrically estimated using data for 1960-61 to 1980-81. They are presented below. Notations are explained in Appendix O. Figures in parentheses indicate t-values.

Construction (C)

$$\log(S_C) = 1.19 + \underset{(2.85)}{1.18}\log(p_C) + \underset{(1.03)}{0.23}\log(PBI) - \underset{(-2.30)}{1.05}\log(p_A)$$

$\bar{R}^2 = 0.74$ D.W. = 1.08

$$\log(D_C) = -1.98 - \underset{(-5.76)}{1.26}\log(p_C) + \underset{(4.62)}{0.99}\log(WY/DY) + \underset{(7.78)}{1.21}\log(DY)$$

$\bar{R}^2 = 0.96$ D.W. = 2.43

Plant and equipment (PE)

$$\log(S_{PE}) = -1.01 + \underset{(0.22)}{0.08}\log(p_{PE}) + \underset{(8.17)}{0.72}\log(PBI) - \underset{(-1.39)}{0.39}\log(p_A)$$

$\bar{R}^2 = 0.98$ D.W. = 1.17

$$\log(D_{PE}) = -1.92 - \underset{(-3.06)}{0.38}\log(p_{PE}) + \underset{(3.12)}{0.53}\log(p_{CNDNT}) + \underset{(5.96)}{0.54}\log(PBI)$$

$\bar{R}^2 = 0.98$ D.W. = 1.12

Foodgrains (FG)

S_{FG} = exogenously given and assumed to grow at given rate per annum.

$$D_{FG} = 0.37 \underset{(-2.49)}{- 0.41} \log(p_{FG}) \underset{(4.10)}{+ 0.54} \log(EXP) \underset{(-1.02)}{- 0.27} \log(WY/DY) + INVTR$$

$\bar{R}^2 = 0.90$ D.W. = 1.87

In the dynamic version, D_{FG} is calibrated for five income groups each in urban and rural areas. The elasticities are presented in Table 1 of Chapter 5.

Consumer non-durables, non-textiles (CNDNT)

$$\log(S_{CNDNT}) = 3.48 \underset{(2.74)}{+0.88} \log(p_{CNDNT}) \underset{(3.74)}{+0.18} \log(CRP) \underset{(-0.45)}{-0.08}(p_{IR})$$

$\bar{R}^2 = 0.92$ D.W. = 2.27

$$\log(D_{CNDNT}) = 0.45 \underset{(-1.60)}{-0.12} \log(p_{CNDNT}/p_{FG}) \underset{(4.11)}{+1.37} \log(EXP/p_{FG})$$

$\bar{R}^2 = 0.73$ D.W. = 1.49

Consumer durables (CD)

$$\log(S_{CD}) = 0.82 \underset{(1.71)}{+0.23} \log(CRP) \underset{(1.99)}{+1.43} \log(p_{CD}) \underset{(-0.30)}{-0.05} \log(INFR)$$

$\bar{R}^2 = 0.91$ D.W. = 1.27

$$\log(D_{CD}) = -1.68 \underset{(10.3)}{+1.61} \log\left(\frac{EXP}{P_{CNDNT}}\right) \underset{(-1.90)}{-0.75} \log\left(\frac{P_{CD}}{P_{CNDNT}}\right) \underset{(0.56)}{+0.26} \log\left(\frac{GCE}{EXP}\right)$$

$\bar{R}^2 = 0.93$ D.W. = 1.62

Services (SE)

$$\log(S_{SE}) = 2.7 \underset{(2.88)}{+0.23} \log(p_{SE}) \underset{(3.43)}{+0.08} \log(CRP)$$

$$\bar{R}^2 = 0.92 \qquad D.W. = 0.86$$

$$\log(D_{SE}) = -2.95 \underset{(-10.6)}{-0.76} \log(P_{SE}) \underset{(14.79)}{+1.13} \log(GDP) \underset{(-4.65)}{-0.25} \log(p_{FG})$$

$$\bar{R}^2 = 0.99 \qquad D.W. = 2.07$$

Cotton textiles (TC)

$$S_{TC} = S_{TCM} + S_{TCD}$$

where

$$\log(S_{TCM}) = 7.66 \underset{(2.22)}{+0.91} \log(p_{TC}) \underset{(-2.49)}{-0.28} \log(p_{CY}) \underset{(-1.89)}{-0.49} \log(p_{CHM})$$

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

$$\log(S_{TCD}) = 6.95 \underset{(1.92)}{+0.26} \log(p_{TC}) \underset{(-0.02)}{-0.005} \log(p_{CY})$$

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

D_{TC} = calibrated for six income groups using elasticities as given in the table below.

Synthetic textiles (TS)

$$S_{TS} = S_{TSM} + S_{TSD}$$

where

$$S_{TSM} = 668.66 \underset{(1.23)}{+9.25} p_{TS} \underset{(-1.27)}{-1.60} p_{SY}$$

[elasticity] [5.83] [-1.11]

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

$$\log(S_{TSD}) = 2.10 \underset{(1.59)}{+1.44} \log(p_{TS}) \underset{(0.93)}{+0.03} \log(p_{SY}) \underset{(-0.69)}{-0.42} \log(p_{CHM})$$

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

D_{TS} = calibrated for six income groups using elasticities as given in the table below.

TABLE: ELASTICITIES USED IN CALIBRATED DEMAND EQUATIONS FOR TEXTILES

Income group	Average income	Own price elasticity	Cross price elasticity	Income elasticity
Cotton				
1	750	-0.87	0.0042	0.67
2	2250	-0.64	0.0116	0.53
3	4500	-0.48	0.0166	0.51
4	8000	-0.25	0.024	0.43
5	15000	0.24	0.040	0.22
6	40000	2.16	0.102	-.471
Synthetic				
1	750	-0.696	0.193	0.981
2	2250	-0.066	0.595	1.092
3	4500	-0.2411	0.483	1.007
4	8000	-0.283	0.457	0.918
5	15000	-0.024	0.622	0.732
6	40000	0.677	1.069	0.745

b. Administered Goods

Supply of administered goods are exogenously given in the static version. In the dynamic version, they are given in the first period, but endogenised from second period onward using given incremental capital output ratios. Thus,

$$S_{at} = \bar{S}_{at} \text{ for } t = 1,$$

$$S_{at} = \bar{S}_{a(t-1)} + \frac{I_{a(t-1)}}{ICOR_a} \text{ for } t > 1.$$

$I_{a(t-1)}$ is the investment allocated to a'th administered sector in period t-1. See equations (1) through (7) of Chapter 5 for determination of $I_{a(t-1)}$.

Final consumption demand for administered goods is a fixed fraction (c) of supply, while intermediate demand is obtained using an input output table. Thus,

$$D_{at} = CS_{at} + AS_t$$

where D_{at} and S_{at} are demand and supply vectors of administered goods, C is a diagonal matrix of consumption coefficients, A is 17x17 input output matrix and S_t 17x1 vector of supplies of all sectors.

c. Financial Market

Bank credit (CREDIT)

$$S_{CREDIT} = -210.13 + \underset{(9.03)}{0.84\ FINSAV} + \underset{(3.61)}{1.34\ DEFICIT}$$

$$\bar{R}^2 = 0.95 \qquad D.W. = 2.25$$

$$D_{CREDIT} = CRG + CRP$$

where CRG = 0.28xPBI, CRP = PRI - PHYSAV - BONDS, when credit is not rationed, and CRP = S_{CREDIT} - CRG, when it is rationed. PHYSAV = 0.48xSAV.

Demand for credit has been described in equations (8)-(12) and (10') of Chapter 2.

B. Income

a. National Income (GDPFC)

GDP at factor cost is obtained as the sum of value added in all commodity sectors:

$$GDPFC = 0.87\times(VO_{FG}+VO_{IR}+11905^{2}) + 0.128\times VO_{CNDNT} + 0.153\times VO_{CD} + 0.16\times VO_{PE} + 0.238\times(VO_{TC}+VO_{TS}) + 0.36\times VO_{C} + (VO_{SE}+18242^{3}) + VAD$$

where $VAD = \Sigma\, v_i VO_i$, i = ISFA, ISCF, COAL, PETROL, POWER, FERT, CEMENT, BIG. The value added coefficients (v_i) are taken from the input output table.

b. Wage Income (WY)

Wage income is obtained as fixed share of value added in agriculture, manufacturing (excluding administered goods), administered goods, construction and services:

$$WY = 0.2278\times[0.87\times(VO_{FG}+VO_{IR}+11905)] + 0.4544\times[0.128\times VO_{CNDNT} + 0.153\times VO_{CD} + 0.16\times VO_{PE} + 0.238\times(VO_{TC}+VO_{TS})] + 0.5664\times VAD + 0.758\times 0.36\times VO_{C} + 0.5162\times(VO_{SE}+18242)$$

---

2 This constant is added to make up for livestock, forestry and logging, and fishing. Note that this is in crores of rupees in 1980-81 *constant* prices. That is, it is adjusted for price changes during simulations.

3 This is added to make up for public administration, defence and other services. This value is also in crores of rupees in 1980-81 constant prices.

c. Disposable Income (DY)

Disposable income is obtained as personal income plus direct taxes net of food subsidies:

$$DY = PERINC - DTR + SUBCD$$

where $PERINC = 0.8439 \times GDPMP$.

d. Income Distribution Among Ten Income Groups

Parallel to the income distribution given by the share of wage income in disposable income, we also compute income distribution among five income groups each in rural and urban areas (see Chapter 2 section 2.3). For this purpose, value added from each commodity sector is distributed among these ten income groups using a value added coefficients matrix. The income accruing to the j'th income group, for example, is $\sum_{i=1}^{17} \alpha_{ij} V_i$ where α_{ij} denotes the share of j'th group in the valued added of sector i. $\sum_{j=1}^{10} \alpha_{ij} = 1$ for each sector i.

C. Budget Constraints

a. Government

The government budget constraint is verified by obtaining deficit as the residual:

$$DEFICIT = GE - GR$$

where $GE = PBI + SUBCD + GCE + GE_{exo} + ATR$

and $GR = DTR + ITR + CRG + GR_{exo} + ARM$

$PBI = PBI_{70} \times (GPI/GPI_{70})$

SUBCD = (Open market price of food - ration price)× Ration quota

GCE = exogenously given in 1980-81 constant prices

GE_{exo} = Other government expenditures given in 1980-81 constant prices.

ATR = Additional transfers for simulation purposes. It is 0 in in the base simulation. Otherwise, it includes any transfers that may arise due to the simulation itself (e.g., consumption subsidy on food).

$DTR = 0.0204 \times GDPFC$

$$ITR = 0.0005 \times VO_{IR} + 0.115 \times VO_{CNDNT} + 0.1264 \times VO_{CD} + 0.02 \times VO_{PE} + 0.0896 \times VO_{BIG} + 0.0494 \times VO_{TC} + 0.163 \times VO_{TS}$$

$CRG = 0.28 \times PBI$

GR_{exo} = Other components of government revenue given in 1980-81 constant prices.

ARM = Additional resource mobilisation, assumed to be 0 in the base simulation.

Note that in our model a discrepancy may arise between costs and equilibrium prices of non-administered goods (see Chapter 2 section 2.4). In the base simulation, the difference, depending on whether it is positive or negative. is added to GE_{exo} or GR_{exo}. In policy simulations, the difference (at the margin) is added to ATR or ARM.

b. Household

Household is a net lender to the government and the business sectors. Its disposable income is spent on consumption of goods and services and the residual is saved. Thus, its budget constraint is:

SAV = DY - EXP

where EXP = $\sum_{i=1}^{17} c_i D_i q_i$. The expenditure here is evaluated at market prices, q_i. Note that some of the demand equations are estimated using gross output (instead of) as the dependent variable. The final consumption is assumed to be a fixed fraction (c_i) of gross output in each sector. where ever the right dependent variable was chosen (e.g., foodgrains), the corresponding consumption coefficient is 1.

SAV is split between PHYSAV and FINSAV in the ratio 48:52. FINSAV includes savings on currency and BONDS. BONDS is assumed to be given in 1980-81 constant prices (=2334 crores of rupees). PHYSAV and BONDS are directly part of private investment. The saving in currency goes either to the banks as deposits or accumulated as idle balances with the household sector.

c. Business

Business sector meets its budget constraint by borrowing from the banks whenever it can, and reduces its investment when credit is rationed. Its budget constraint, therefore, is given by the credit demand equations described in section A above.

D. Equilibrium and Adjustment Mechanisms

Equilibrium is obtained when

(i) $S_f(.) = D_f(.)$ for all 8 non-administered goods;

(ii) $(1-c_\alpha)S_\alpha \geq D_\alpha$ for all 9 administered goods;

and (iii) $S_{CREDIT} \geq D_{CREDIT}$

Equality between supply and demand in non-administered sectors is achieved through adjustment in prices and/or change in stocks.

For administered goods and credit, if supply exceeds demand, there will be idle inventories. If demand exceeds supply, imports are resorted to for administered goods. Thus,

$M = \Sigma_\alpha D_\alpha - S_\alpha$, for all α s.t. $D_\alpha - S_\alpha > 0$.

If demand exceeds supply in credit sector, credit to the private sector is rationed.

E. General Price Index (GPI)

GPI is obtained as a weighted average of all sectoral prices:

$$GPI = 0.12922 \times P_{FG} + 0.10621 \times P_{IR} + 0.18624 \times P_{CNDNT} + 0.012 \times P_{CD} + 0.015 \times (P_C + P_{PE}) + 0.04107 \times P_A + 0.4 \times P_{SE} + 0.09743 \times P_{TC} + 0.01293 \times P_{TS}$$

Where P_A is a weighted average of all administered prices except IR, using value added coefficients as weight:

$P_A = \Sigma_\alpha v_\alpha P_\alpha$, a = 1,....,8.

APPENDIX III

EXOGENOUS VARIABLES

Name of variable	Value	Unit		
GCE_{70}	1895.45	Rs crores in 1970-71 prices		
GE_{exo}	10090.17	"	"	"
GR_{exo}	7970.85	"	"	"
$INFR_{70}$	3648.27	"	"	"
PBI_{70}	4510.77	"	"	"
INVTR	15	Million tonnes of foodgrains		
Q	14.9	"	"	"
S_{FG}	129.6	"	"	"
P_{CHM}	342.4	Price index with 1970-71 = 100		
P_{CY}	237.2.	"	"	"
P_{SY}	239	"	"	"
P_r	125	"	"	"
S_{ISFA}	4007.53	Rs crores in 1980-81 prices		
S_{ISCF}	1354.74	"	"	"
S_{COAL}	1452.87	"	"	"
S_{PETROL}	399.66	"	"	"
S_{POWER}	4099.94	"	"	"
S_{FERT}	1875.99	"	"	"
S_{CEMENT}	718.36	"	"	"
S_{IR}	21605.99	"	"	"
S_{BIG}	9997.29	"	"	"