

PLANNING FOR BASIC NEEDS IN INDIA

A Thesis submitted to Indian Statistical
Institute for the award of the
Degree of Doctor of Philosophy

by

MANOJ KUMAR PANDA

Revised

May 1991

SEE ENCLOSED SUPPLEMENT.

Acknowledgement

I acknowledge with gratitude the invaluable help received from Professor Bhaskar Dutta, who supervised the preparation of this thesis. My debt is also due to Professor Santi Chakrabarti for supervision of the early portions of this work and for permission to include two of our joint papers in chapter 2 and 3. Both of them took keen interest and gave many useful comments. I am grateful to Dr. K.C. Majumdar for the pains he took in teaching me the formulation and operation of Indian plan models.

I have received constructive suggestions on a number of points from Dr. Hiren Sarkar and Dr. Shashanka Bhide of NCAER, New Delhi. Many present and former faculty members of ISI offered ready help at various stages. Among them are Professors N. Bhattacharya, S. Bose, D. Coondoo, J.K. Ghosh, P. Maiti, R. Mukharjee, A. Rudra, T.N. Srinivasan and S.D. Tendulkar, whose comments have been helpful in different chapters. Some discussions with Professors N. Stern, A. Deaton and R. Radhakrishna also proved useful. The material in chapters 4 to 6 were presented at seminars held in Delhi School of Economics and ISI, Delhi; and I had the benefit of comments from participants, particularly Professors M. Dutta Chaudhuri and Debraj Roy. Mr. I.Z. Bhatti, Director General, NCAER always encouraged me to complete the work and permitted me to use the necessary computer and other facilities. Mr. Ashok Banerjee drew the figures and Mr. D.P. Sharma typed the manuscript with care. I am grateful to all of them. Finally, I acknowledge the understanding received from my wife, Puspa when on several occasions I had devoted greater attention to my thesis than to my family.

CONTENTS

	<u>Page</u>
CHAPTER 0 : INTRODUCTION	1
0.1 : Evolution of Basic Needs Approach	1
0.2 : Provision of Basic Needs in Indian Plans	3
0.3 : The Absorption Problem	21
0.4 : Scope of Present Study	24
CHAPTER 1 : SURVEY OF PLAN MODELS	31
1.1 : Evolution of Indian Plan Models	31
1.2 : Structural Details	37
1.3 : Use of Linear Expenditure System	49
1.4 : Prices in Multi-sector Models	53
CHAPTER 2 : INDIAN ECONOMIC GROWTH AND THE BASIC NEEDS GOODS (BNG) INDEX	59
2.1 : An Overview of Growth and Poverty	59
2.2 : The Basic Needs Goods Index	63
2.3 : Choice of Items and Calculation of Weights	72
2.4 : The BNG Index and Comparison with GDP	75
2.5 : Conclusion	87
CHAPTER 3 : NUTRITIONAL ISSUES	89
3.1 : Introduction	89
3.2 : Discussion of Sukhatme's Model	91
3.3 : Questions on Adaptation	99
3.4 : Balanced Diet	102
CHAPTER 4 : ABSORPTION PROBLEM AND INCOME PRICE STRATEGY	107
4.1 : Introduction	107
4.2 : Choice of Income Price Strategy	109
4.3 : Income Price Determination Method	112
4.4 : An Application	116
4.5 : Conclusion	122

CHAPTER 5 :	A PLAN MODEL INCORPORATING NORMATIVE MINIMUM CONSUMPTION TARGETS	125
5.1 :	Introduction	125
5.2 :	Consumption Norms, Price Structure and Poverty Line	126
5.3 :	Consumption and Output Structure	133
5.4 :	Conclusion	145
	Glossary	148
CHAPTER 6 :	EMPIRICAL OPERATION OF PLAN MODEL	151
6.1 :	Parameter Estimation	151
6.2 :	Empirical Results	156
CHAPTER 7 :	CONCLUSION	181
7.1 :	Summary	181
7.2 :	Appraisal	184
	APPENDIX : PARAMETER VALUES WITH EXPLANATIONS	188
	REFERENCES	201

SUPPLEMENT (enclosed)

Chapter 0

INTRODUCTION

0.1 EVOLUTION OF BASIC NEEDS APPROACH

Problems of economic development have received a great deal of attention in the last four decades. This has led to the evolution of several development goals like growth, redistribution, poverty alleviation and basic needs satisfaction. Initially, development strategies were geared to achieve maximum feasible growth rates. It was generally felt that the benefits of growth would spread widely to different sections of the population and in particular would percolate to the lower income groups. Judged by growth in national income, the development efforts have been successful, though to varying extent in different countries. But the percolation hypothesis either did not work or worked slowly. Even in the early years scepticism about percolation was expressed in some quarters. International comparison of time series and cross section data showed that inequality tended to grow with rising per capita income upto a point in the early stages of development (Kuznets, 1955). This meant that the poor might have to tighten their belt in the first phase of growth.

Despite decades of continued growth, poverty prevailed substantially in underdeveloped countries. It was then thought that a minimum desirable standard of living should be provided to all people as a first priority. Development economists thus turned their attention to an absolute concept of poverty. While poverty in the relative sense is measured

against the level of living of a reference person or group, poverty in the absolute approach refers to a level of living so low that it prevents the normal development of human physical well-being. For operational purpose, an absolute poverty line (PL) is defined as the per capita income level that is just sufficient to enable a person to be fed a nutritionally adequate diet. Persons whose income fall below the PL are identified as poor. Improvement in income of the poor at least upto the PL forms the poverty eradication objective in a development plan.

The basic needs approach to development is a further evolution of poverty eradication policy. In a section of the literature the objective of satisfaction of basic needs and that of poverty alleviation are regarded as synonymous. Some authors, however, prefer to maintain a distinction between the two objectives. It has been pointed out that a distinctive feature of the basic needs approach lies in its emphasis on fulfilling the needs of particular goods and services at some minimum levels. The focus in the basic needs approach is shifted from provision of income to that of specific commodities (Streeten, 1981, ch. 1).

This study analyses some of the issues related to planning for basic needs in India. The problems investigated here essentially arise when a plan aims at provision of a bundle of consumer goods at some minimum levels. In order to appreciate the nature of the specific aspects examined in the present work, it will be useful to briefly discuss the basic needs strategies followed in various Five Year Plans in India.

0.2 PROVISION OF BASIC NEEDS IN INDIAN PLANS

The constitution of India enunciated certain Directive Principles of State Policy which declared that the state shall direct its policy towards securing, among other things, "that the citizens, men and women equally, have the right to an adequate means of livelihood". Accordingly, provision of basic needs, in one form or other, has been a principal objective of the Five Year Plans in India right from their inception. In the first phase covering the 1950's and 1960's, the objective was stated in a general way as raising the standard of living of people. The second phase started with the adoption of the Fifth Five Year Plan in 1974 and the BN objective was stated in more specific terms. Poverty alleviation in the sense of provision of an explicitly quantified absolute minimum level of living has been a prime objective since then. Each Plan in the second phase has targeted for the upliftment of certain section of people up to the minimum level during the five-year plan period with the ultimate objective of removing poverty altogether over a longer time horizon. The strategy formulated to achieve the BN objective in Indian plans has been summarised in the phrase "growth with redistribution", though the policies in the first phase were mostly geared towards the general growth process. In the second phase the growth policies were accompanied by direct income enhancing policies oriented towards target groups.

Specification of BN Targets

In the first phase, the BN objectives specified in the plans by and large coincided with the general development objectives of the economy, i.e., growth, redistribution and employment promotion. While the plans mentioned the need to effectively tackle the problem of mass poverty and to make provision of 'adequate' or 'tolerable' level of living, specific targets were not spelt out. There was no quantitative statement of what exactly constituted the 'adequate' or 'tolerable' living. Some relative directional movement was, however, implicit in the redistribution objective in the obvious sense that the poorer sections would receive a larger share of the overall incremental income than the richer sections.

Income-Consumption Provision

In 1962 the Perspective Plan Division (PPD) of the Planning Commission prepared a definitive document which advocated that development planning must be concerned with meeting the minimum needs of the people 'both on humanitarian grounds and as an essential condition for orderly progress'. This document is considered as the first attempt outside the Socialist economies to work out the implications of introducing a target for the minimum level of living of the people within the framework of a plan model. A working group of the Planning Commission had quantified the desirable minimum level of living as consumer expenditure of Rs. 20 per capita per month at 1960-61 prices, which was sufficient to buy 'a physical volume of commodities'. PPD (1962) set targets to ensure this minimum standard of living for 80 per cent of the

population over a 15-year period : 1960-75. Although the paper was prepared during the Third Plan, such a quantitative target was not adopted in the official plans for about another decade.

The Fifth Plan, which marked the beginning of the second phase, explicitly stated poverty alleviation as a prime objective. It defined a poverty line in terms of the minimum level of living as quantified in PPD (1962) and set the target in terms of raising the per capita expenditure of the lowest three deciles of the population up to the poverty line.

The approach followed to estimate PL in the Sixth Plan and subsequent ones was formulated in the Report of Task Force on Projection of Minimum Needs and Effective Consumption Demand set up by the Planning Commission (PPD, 1979). The Task Force considered the calorie requirement for various age-sex-activity groups of the population as recommended by the Indian Council of Medical Research and the proportionate share of these groups in total population. It estimated the per capita per day calorie requirement of the Indian population as 2400 and 2100 calories in rural and urban areas respectively. Using household consumption survey data collected by the National Sample Survey Organisation (NSSO), it computed the per capita calorie intake of households taking into account the consumption levels and the calorie content of the food items. The PL was then estimated as that level of per capita total consumption expenditure (PCE) where the calorie intake equals the average calorie need. The estimat-

ed level of PL turned out to be monthly PCE of Rs.49.09 and Rs.56.64 for rural and urban areas respectively at 1973-74 prices.

The above Task Force's estimates of PLs constituted the 'base' PLs for the Sixth Plan. These lines were updated to 1979-80 prices for their use in the plan because all other calculations were at those prices. The updating was carried out with the help of a suitable price index to ensure that the PL used in the plan had equivalent purchasing power as that of the base PL under the assumption of constant consumption pattern. A similar procedure was followed in the Seventh Plan. While the wholesale price index was used for updating the PL in the Sixth Plan, the authors of the Seventh Plan chose the consumption deflator implicit in the National Accounts Statistics (NAS) of the Central Statistical Organisation (CSO).

The quantitative targets on incidence of poverty specified in the Indian plans have varied over the years. Since the PLs used in the Sixth and Seventh Plans were on a comparable footing, it might be useful to make a comparison of the targets in these two plans (see, Table 0.1). The Sixth Plan (1980-85) estimated that about 48% of the population lived below the PL in 1979-80, which formed the base year of the plan. It targeted to bring down the percentage of poor to about 39% through the mechanism of growth assuming no change in consumption distribution and to as low as 30% through both the growth and redistribution mechanisms by 1984-85, the terminal year of the plan. Even though the Sixth Plan achieved its targeted GDP growth, the achievement on the

poverty front was modest. The incidence of poverty actually declined to only 37% by the year 1984-85. Although the target of bringing down the percentage of poor to 30% could not be attained during the Sixth Plan, the success achieved in reducing poverty by about 11% over five years was significant in relation to the previous record. The Seventh Plan targeted to reduce poverty to about 26% by the year 1989-90. This included the effect of both growth and redistribution. The poverty reduction target in the Seventh Plan was thus moderate compared to the previous plan target. The observed percentage of poor in 1989-90 has provisionally been estimated at around 29%.

Table 0.1

Target on Percentage of Poor in Sixth and Seventh Plans

	Observed Level 1979-80	Sixth Plan Target 1984-85	Observed Level 1984-85	Seventh Plan Target 1989-90
		(a)	(b)	
Rural	50.70	40.47	30.00	39.90
Urban	40.31	33.71	30.00	27.70
All-India	48.44	38.93	30.00	36.90

Note : (a) refers to target without redistribution
(b) refers to target with redistribution.

A few observations may be made on estimates of poverty made in the Indian plans. First, the adopted definition of PL implies that households with this level of PCE will, on an average, spend on food an amount adequate enough to meet the given calorie norm. It permits expenditures on other needs at behavioral levels and assumes that each individual is the best judge in deciding his or her non-calorie needs.

Secondly, the price index appropriate for the updating procedure should use a weighting diagram based on the consumption pattern of the people at or around the PL in rural or urban areas. Minhas et.al. (1987) have attempted to construct such price indices and have found that the price movements faced by the poor in rural and urban areas were different and that both were different from the deflators used in the plans. The choice of a suitable price index is not easy and researchers have obtained different time trends in incidence of poverty by using different price indices (see, for example, Bardhan, 1973; Minhas et.al., 1987). The ideal alternative is, of course, to use consumption survey data for different years and estimate the PL afresh satisfying the chosen calorie norm. This procedure, if feasible, would take into consideration the changing relationship between calorie consumption and PCE of households. But, non-availability of consumption survey data on yearly basis does not permit such fresh estimate of PL every year.

Thirdly, the use of ICMR recommended calorie norms used in the plans has been questioned by Sukhatme and others on the grounds that it is not the minimum requirement of individuals, but relates to the average among the healthy and active individuals. Sukhatme's arguments have led to an extensive debate and these issues are examined in detail in chapter 3.

Fourthly, there are considerable differences between the two series of aggregate private consumption figures available in India from two sources - one through direct

household surveys by the NSSO and another through commodity flow method in NAS by the CSO. While estimating the incidence of poverty the Planning Commission adjusts the NSSO consumption distribution figures taking as control the estimate of aggregate consumption expenditure given in NAS. The adjustment is carried out since the plan projections need to be based on a consistent accounting framework related to production, income, consumption, investment and trade transactions. NSSO provides only private consumption estimates and their direct use would give rise to inconsistent and implausible results. For example, if we adopt NSS private consumption estimates and GDP estimates of CSO, then the implied savings rate would turn out to be 'above 25-30 per cent and fast increasing over time'. This can not be supported by available statistics on domestic investment and foreign savings (Gupta, 1989).

Concentrated attention being given to calorie needs, the plans have mostly bypassed the problem of provision of other nutrients at adequate levels. The First Five Year Plan, however, contained a clear recognition of the problem. It took into account investigations by experts into nutritional requirements of Indians and compared them with actual average consumption or availability information obtained from diet surveys. It concluded that the average Indian diet was lopsided primarily because of its extremely high cereal content. The diet lacked in adequate levels of 'protective foods leading to inadequacy and very often to total lack of proteins of good quality'. Another important feature was inadequacy of minerals and most of the important vitamins in

varying degrees (see, Planning Commission, 1951, P.498-500). Noting these conclusions, the First Plan argued for higher growth rates in non-cereal food sector.

Other Means

Provision of adequate income to the poor permits consumption of one set of goods, namely those transacted through the market. Another set of basic needs duly recognised in the Indian plans relates to provision of certain social services like health, education, sanitation and safe drinking water. In India these services are meant to be supplied by the state free (or nearly free) of charge to the people. These essential items belong to the category of 'merit goods', which provides a rationale for their public provision. Here again, the Fifth Plan laid down certain minimum norms of social consumption for the priority areas, which were identified as elementary education, rural health, nutrition, drinking water, provision of house sites, slum improvement, rural roads, and rural electrification. The inclusion of the last two areas in what was known as 'National Programme of Minimum Needs' was because of the fact that the priority package was selected "taking into account not only the broader consideration of assuring a minimum in terms of the overall quality of life, but also the role played by various facilities in supporting the process of sustained economic development" (Planning Commission, 1973, P.87). In the Sixth Plan, the list of minimum needs to be provided through public services was extended to include adult education and the norms were also changed to improve the coverage.

A point to note is that the norms for public services have been fixed at the average level for the entire population (i.e. one doctor for so many thousand population) and not for any specific target group. The benefit in most of the services accrues disproportionately to various socio-economic groups. The influential non-poor groups preempt the facilities in some cases. As a result the access of the poor to public services gets limited. Another point is that the item nutrition is included in the above package only as a supplementary item, because nutritional requirements were primarily to be met through private consumption. The scheme involved supplementary meals for such vulnerable groups as pregnant women, lactating mothers and preschool or school going children.

Government intervention in procurement and distribution of food grains has been a major element in provision of adequate foodgrains for the people, specially in urban India. The public distribution system (PDS) was developed to assure reasonable spatial and temporal stability in the availability and prices of foodgrains. The PDS aimed at procuring a part of excess production of foodgrains (principally wheat and rice) from surplus producers and distributing it through a network of fair price shops. The price charged by the PDS are lower than the market price and thus carry an element of subsidy with it. The PDS network, beginning with the urban areas, has progressively been extended to the rural areas in recent years and has covered some other food items like sugar and edible oils. The food subsidy involved in the operation of PDS amounts to about 2% of total Central Government budget in recent years. Some experts have advocated limiting the

coverage of PDS to lower income groups so as to release more funds for other activities of the government.

Special provisions have been made in all Indian plans for certain backward classes known as 'scheduled castes' and 'scheduled tribes', who have historically been victims of social oppression and discrimination. These classes, constituting about a fifth of the population, get educational concessions in the form of stipends, scholarships, free tuition and provision of books and stationary. Also, certain percentage of jobs in the public sector have been reserved for them along with some relaxation in educational qualification, experience, and age for entry into the jobs.

It is also recognised in the plans that another group of people might not be able to derive any benefit from the normal production and income generation process of the economy. This group constitutes destitutes, orphans, sick and aged. Their level of living could be improved by special means like income transfer and social expenditure. But no significant and concrete measures have been adopted for this purpose.

Strategy Followed

For enhancing income of the poor, the Five Year Plans have followed a twin strategy of relying on the growth process and on the redistribution measures. It was recognised in the First Plan that poverty alleviation could not be achieved merely by redistribution of existing income and wealth.

Substantial expansion in production potential of the society was considered to be an essential condition. At the same time, it was also recognised that growth must be accompanied by redistribution measures to have a significant impact on elimination or reduction of poverty. It was felt necessary to reorganise the socioeconomic framework for this purpose with the main focus on land reform policies related to abolition of intermediaries, guarantee of tenancy rights, fixation of land ceiling and the distribution of surplus land. Although some land reform measures were carried out by abolition of intermediaries, there were several constraints with regard to other measures. Large scale asset redistribution programmes were not easy to implement within the framework of political democracy and mixed economy.

The growth policies received priority over distribution measures in practice and the BN strategy basically depended on the growth process upto the Fourth Plan. The policies were consequently directed towards generation of maximum possible savings and investment. The role of industrialisation in generating growth was emphasised by policy makers. A per capita income growth of around 3 per cent per annum had been targeted by the plans and it was presumed that the benefits of growth would spread over all sections of the society and in particular would trickle down to the low income groups. Actual experience, however, turned out to be different. The per capita income grew only by a little over 1 per cent on a trend basis upto mid-seventies. As some have put it, there was indeed very little to percolate to the poor (Srinivasan, 1986; Gupta, 1989).

This led to the realisation that not only greater effort to raise GDP growth rate was necessary, but special programmes for the poor were required. The Fifth Plan formulated in the early seventies had admitted the failure of the trickle down mechanism and stressed the need for special target group oriented programmes meant to directly help the poor. As a result, several special programmes for the upliftment of the poor were launched. Such programmes had direct income implications for the beneficiaries and were intended to play complementary role to the growth process in providing a minimum income to the poor.

The special programmes broadly fall into two categories: (a) area oriented, and (b) individual oriented. The first category includes the tribal sub-plan and the drought prone area programme (DPAP). The tribal population are located in inaccessible forest areas and are hardly integrated with the mainstream of the economy. Being isolated, they are not able to take advantage of the general growth process. Hence, the need was to open these areas and bring the tribals in contact with the mainstream. The tribal subplans were adopted earmarking special financial allocation for development of the tribal areas. The DPAP was initiated to tackle the impact of droughts in the ecologically disadvantaged areas which were prone to droughts. The small and marginal farmers and agricultural labourers were regarded as target groups in this programme. Because of the heavy concentration of poor in tribal belts and drought prone areas, these two programmes, though area oriented, were essentially antipover-ty in nature.

The individual beneficiary oriented programmes aim at helping the poor either through wage employment or through self employment. Several programmes have evolved in the last two decades which aim at providing wage employment to landless labourers and marginal farmers during off-agricultural season when employment opportunities are limited in rural areas. These programmes undertake activities related to creation of certain durable community assets like village roads, minor irrigation facilities, school building, etc. The Food For Work (FFW) programme was introduced in 1977 and was replaced by National Rural Employment Programme (NREP) in 1980. Part of the wages in FFW and NREP is paid in foodgrains so as to utilise surplus foodgrain stocks and to protect entitlement of the poor from price fluctuations. The target in NREP was to generate employment ranging between 300 and 400 million man days per annum. Another programme started in 1983 is Rural Landless Employment Guarantee Programme (RLEGP). It aims at guaranteeing employment up to 100 days per year, mostly during the lean period, to at least one member of a landless labour household. NREP and RLEGP were very similar schemes, differing mainly in coverage and administrative arrangements. Both the programmes were merged into a single one in 1989 and aimed at creating employment at an extended level of 650 million man days. Among the state level programmes, the well known Employment Guarantee Scheme (EGS) has been in operation in Maharashtra since 1972. It aims at providing public works to all those who are willing to do manual work at fixed minimum wage rate.

A comprehensive development programme started in 1978 was the Integrated Rural Development Programme (IRDP). Its objective was primarily to assist households below the PL to raise their income through self employment. It was expected to contribute significantly to the poverty removal objective in the Sixth and Seventh Plans. While the FFW, NREP and RLEGP were designed to help the poor through wage employment, the IRDP aimed at providing a package of productive assets for self employment keeping in view the availability of local resources. The capital cost of the projects are subsidised by 25-33% in most cases, but the subsidy goes up to 50% in some cases like tribal households. IRDP covers 3-4 million beneficiaries per year.

While creation of additional employment opportunities is visualised as a principal means for raising the level of living of the poor, employment by itself has not always been regarded as an end, i.e. as an objective in its own right. The Fifth Plan, for example, clearly cautions: 'Providing for greater employment is a very important consideration for planning. But sufficient care should be taken to ensure that employment provision does not become an end in itself' (Planning Commission, 1973, p.23). In contrast Draft Five Year Plan 1978-83 treats employment as an end in itself along with other goals. The three principal objectives it defined to achieve within a period of ten years are ordered as follows: (i) the removal of unemployment and significant underemployment, (ii) an appreciable rise in standard of living of the poorest sections of the population and (iii) provision by the state of certain minimum needs. These

primary objectives were to be achieved while attaining a higher growth rate, reducing inequality and making progress towards self-reliance. The Eighth Plan initiated in 1990 also states provision of employment opportunities as the prime objective.

Evaluation

Several evaluation studies note that the direct anti-poverty programmes have more or less achieved their stipulated targets in terms of expenditure and employment generation. Doubts have, however, been raised about the benefits having reached the target groups to the extent aimed at in the schemes. Even though it is agreed that the programmes have, on the whole, made favourable impact on the conditions of the poor, criticisms have been made on several grounds [see, Dandekar (1988), Narayana et. al. (1988), Ahluwalia (1990), and Chakravarty (1990) for some of the recent discussions on the problem] :

(a) Assets created in the wage employment programmes are not of durable quality. It is alleged that rural roads built through the programmes get washed away in the first rain.

(b) Activities undertaken in the programmes are not of potentially productive type such as renovation of tanks, minor irrigation works and soil conservation. Such activities increase the productivity of land resource leading to long term income and employment generation capability of local agriculture.

(c) Some of the beneficiaries are wrongly identified from the non-poor group, who are not intended to be in the target group of the programmes. While wrong identification is a

valid criticism in the IRDP, it may not be a serious criticism in the wage employment programme. So long as wages paid are not much higher than the PL, the beneficiaries would mostly be from the target group.

(d) Even where the benefit has gone to the poor, it is alleged that the marginally poor have benefited more than the very poor. Since it is easier to bring the marginally poor above the PL, the evaluation criterion of success on the basis of number of households crossing the PL might influence the officials in-charge to concentrate among those who are not far below the PL, while the programmes aim at focusing on 'the poorest among the poor'.

(e) Some of the activities in IRDP are ineffective because of the absence of adequate support structure like provision of quality inputs, infrastructure and marketing facilities. Measures need to be taken to provide institutional support for this purpose and also to select viable projects.

(f) The IRDP programme seeks to promote self employment by providing the poor households with productive assets financed by subsidised bank credit. A poor household, which has lived in poverty for generations, may not easily achieve entrepreneurship so as to be able to operate within market forces.

(g) It has been admitted that large scale leakages occur in these programmes due to collusion among the implementing authorities and vested interest groups. Misappropriation of funds means that expenditure is incurred but no real employment takes place.

The shortcomings in implementation of these programmes notwithstanding, major benefits have accrued to some of the

poor. There is a need to take an integrated approach to various poverty alleviation programmes as also to establish effective linkages with other developmental activities aimed at creation of socially productive assets. The intended beneficiaries should be actively involved in the implementation of the programmes. With proper design and implementation, the target group oriented programmes could go a long way in providing the poor with capability for acquiring their basic needs.

The allocation of funds for such programmes have been too small in relation to the requirement of the problem. Dandekar (1988) estimated that the resource allocation for such programmes taken together at best covered only a third of the total requirement during the Sixth Plan and early years of the Seventh Plan. Ahluwalia (1990) concluded that the wage employment programmes provided jobs for less than 1% of the rural work force, while the NSS estimates have indicated about 7% as the unemployment rate (on a 'daily status basis').

The target group oriented programmes are in recent years constrained by availability of budgetary resources. The assets created particularly in the wage employment programmes do not turn out to be productive in the sense of generating revenue and so they cannot be continued on a self sustaining basis. Thus, any expansion of these programmes calls for more budgetary support. Since resources can be diverted from general growth process to direct programmes, one may examine the possible trade-off between these two approaches. Narayan et.al. (1987) explore this possibility within a general equilibrium framework. They conclude that if

a large scale rural works programme (involving approximately 6% of GDP over a 20 year-period) is financed by reducing the level of investment in the economy, the cost in terms of fall in GDP growth rate is modest (about 0.25% per annum), while the income gain to the poor is substantial. In the terminal year GDP is lower by 4.6%, but income of the two poorest classes is higher by 40% compared to the base run. Such simulations under different alternative assumptions could throw useful insights into cost benefit of the competing strategies.

To summarise, Indian plans have always expressed concern for provision of basic needs of life to the people. Such concern has been translated into quantitative targets since mid-seventies. The strategy adopted in the plans in this regard puts emphasis not only on the growth process but on direct target group oriented programmes as well. These programmes either provide wage employment or support self employment. In addition government directly provides certain public services which help in improving level of living of the poor. The result achieved has been a mixed one. There has been some success; but, it has fallen short of expectations. The direct programmes are likely to compete more in future with the general growth objective for scarce resources. It may be necessary to steer the general growth process itself in such a way that the poor receives significant benefit from it.

0.3 THE ABSORPTION PROBLEM

The discussion in the previous section reveals that the basic need strategies followed in Five Year Plans in India have centred around meeting the minimum income target rather than explicitly attempting to provide for the minimum consumption of a basket of basic need goods. The income target is defined with the help of a calorie based poverty line. Given the observed consumption behaviour of the population, households at or above the PL meet the average calorie need of their members. While the First Plan recognised severe inadequacy in intake of non-calorie nutrients, the subsequent plans have almost totally neglected this aspect. The plans have not attempted to fix any normative target for nutrients other than calorie.

In a section of the literature, the PL is, however, constructed based on a basket of basic need goods taking into consideration calorie as well as non-calorie needs. Authors like Bardhan (1973) and Rudra (1974) specify food consumption norms through a balanced diet basket and compute the cost of this basket at prevailing prices. They then estimate the PL as that level of per capita income where a typical consumer spends on the basic need goods an amount equal to the cost of the basket. If such a PL is considered in a plan, the target group, when raised upto the PL, acquires the purchasing power to buy the basket. But the target group may not spend its income to consume the basic need goods at the normatively specified levels, i.e. the behavioural consumption levels may be different from the normative levels. Thus, the problem of 'absorption' of the normative basket by the consumers arises.

The absorption problem is not just a theoretical possibility, but it also occurs in practice. To demonstrate its occurrence for India, we consider the PL constructed by Rudra (1974) and the actual consumption pattern of people near the PL. Rudra uses the balanced diet basket worked out by Sukhatme (1965). This basket and the unit prices in 1960-61 for rural area used by Rudra are reproduced in Table 0.2 (columns 1 and 2). Column 3 shows the required consumption expenditure on different items as implied by the first two columns. The expenditure required to consume the balanced diet is Rs. 15.72 per capita per month. Using NSS consumer expenditure data for 1960-61, Rudra estimates the PL as per capita total consumer expenditure (PCE) of Rs. 22.73 per month at 1960-61 prices. The observed expenditure by rural PCE class Rs. 21-24, which contains the PL, on various food items as available from NSS data for 1960-61 are given in column 4 of Table 0.2. A comparison of the last two columns reveals that the observed consumption pattern of people at the PL is very different from the normative pattern. For cereals, for example, the observed expenditure is nearly double the required level. On the other hand, for some items like milk, edible oils, and meat-fish-egg, the observed expenditure is much lower than the normatively required amount. Similar conclusions also broadly follow, if one uses the food basket selected by Bardhan (1973), though an exact comparison in this case is not possible because the food norms used by Bardhan are on per adult basis while the NSS figures are on per capita basis.

TABLE 0.2

COMPARISON OF CONSUMPTION NORMS AND ACTUAL CONSUMPTION
AT POVERTY LINE : RURAL INDIA (1960-61)

Item	Sukhatme's Basket	Unit price 1960-61 (Kg. per day per capita)	Normative Consumption (Per Kg.)	Actual Consumption at Poverty Line *
	1	2	3	4
1. Cereals	0.403	0.400	4.836	9.35
2. Pulses & nuts	0.104	0.600	1.872	1.01**
3. Sugar	0.050	0.600	0.900	0.77
4. Milk	0.201	0.500	3.015	2.26
5. Edible oils	0.018	2.250	1.215	0.67
6. Meat	0.007	2.130	0.447	0.54
7. Fish & eggs	0.019	1.500	0.855	
8. Starchy roots	0.046	0.375	0.518	-
9. Fruits & vegetables	0.137	0.500	2.055	-

* Consumption by per capita expenditure class Rs.21-24. which contains the poverty line

** Excluding nuts.

Source : Rudra (1974) for columns 1 and 2. NSS Report No. 138 for column 4.

The problem of absorption is obviously an important one in the basic needs approach to development. The problem has been noted earlier by some authors. Bardhan (1973) hinted at it when he said people might not choose diet according to the nutritional norms and "it may not be uncommon to observe seriously undernourished people even in expenditure groups above the poverty line". Ghai et. al. (1977) and Rudra (1978) are more explicit in recognising the absorption problem. Manipulation of the price system and a general rationing scheme are among the measures suggested by them to solve the problem. The empirical implications of adopting these solutions have not been examined by them. Moreover, in the context of planning for basic needs, most of the existing plan models with their constant price characters are not suitable to examine the consumption and production structure required for meeting normative consumption targets. There is a need to integrate the conventional structure of a plan model with a method of solving the absorption problem.

0.4 SCOPE OF PRESENT STUDY

The present study examines some problems in the basic needs approach to economic development with special reference to India. One problem we examine relates to evaluation of the performance of an economy in the sphere of basic need goods. Another problem is an examination of the nutritional issues relevant for setting food consumption targets on normative basis. After discussing these two problems, the study proceeds to analyse the problem of absorption of the normative basket by the consumers and incorporation of the norma-

tive targets into a plan model. An income-price strategy is used to solve the absorption problem. Subsequently, this solution procedure is integrated with a plan model in order to analyse implications of meeting commodity specific targets in a basic needs plan. The chapter-wise coverage is as follows.

In chapter 1 we start with a survey of plan models with specific reference to those models which attempt to incorporate the minimum level of living target. The survey includes models that endogenously specify prices within the broad planning framework. It also covers the use of Linear Expenditure System in Indian plan models and plan related works.

The conventional national income measures like Gross Domestic Product (GDP) are not considered as good yardsticks to monitor satisfaction of basic needs (Hicks and Streeten, 1979). In chapter 2 an index called the Basic Need Goods (BNG) index is developed to evaluate economic growth of an underdeveloped country where provision of basic needs is the primary objective of economic policy and programmes. The BNG index is a summary measure of per capita production of a basket of goods and services counted as basic needs of life. For aggregating the heterogeneous elements in the BNG basket, a system of weights is derived from considerations of consumer preferences. The BNG index is then used to evaluate performance of the Indian economy since 1951 and the results are compared with those obtained from conventional GDP measures.

In the subsequent chapters we move on from past performance to future planning. The first problem in any planning exercise would relate to setting the plan targets. Since the nutritional considerations provide the normative basis for fixing absolute food consumption targets, chapter 3 is devoted to an examination of the relevant nutritional issues. An important debate has taken place in recent years on the choice of a critical calorie limit for measurement of undernutrition. The debate started due to an 'adaptation' hypothesis put forth by Sukhatme (1978, 1982) and is important because the critical calorie limit is a major determinant of the size of the basic needs plan. We attempt to bring out in chapter 3 the different status of the inter- and intra-individual components of variability in calorie requirement and discuss the possible errors and associated risks involved in accepting different positions in the calorie debate. We then discuss the need for considering other nutrients like protein, fat, vitamins and minerals needed for the human body and argue for considering normative food consumption targets in terms of a balanced diet basket for India.

Next, we look into the instruments to achieve the consumption targets. Income is obviously a necessary instrument. But mere provision of adequate income to buy the normative consumption basket is not sufficient due to presence of the absorption problem. In chapter 4 it is suggested that the income target should be supplemented by a price strategy to deal with the problem. The various income-price strategies that would ensure consumption of BNGs at least at the normative levels are discussed and the one

that does not involve excess consumption of any good, over the normative level, is chosen. A method is then developed to obtain the income-price solution which induces the consumer to adopt the normative consumption pattern. It is assumed that consumer behaviour is represented by Linear Expenditure System (LES) due to Stone (1954). Given that the consumption levels of BNGs would be at the normatively specified levels, we use LES to get solution for price of BNGs and consumption level of non-BNGs. The non-BNG prices are specified exogenously. The corresponding total consumer expenditure on BNGs and non-BNGs defines our PL. This PL and the prices estimated through LES provides an income-price strategy that solves the absorption problem.

In the next chapter, this solution procedure is extended to make the framework more general and it is integrated with the usual structure of a plan model. One extension relates to a feedback mechanism from solution prices to the consumption norms. A standard method of obtaining a balanced diet involves a cost minimising programming problem satisfying the nutritional constraints. The normative targets (exogenously specified above) would, thus, in general depend on prices used for cost computation. To capture this feature, a feedback mechanism is established from the prices that solves the absorption problem to the cost minimising diet problem. In other words, the consumption norms are revised in the light of the prices required for ensuring absorption.

Another extension relates to introduction of a cost based price determination system where the prime cost is

inflated by a markup rate and an indirect tax rate to give the market price of a commodity. This helps in making the non-BNG prices (treated exogenously earlier) endogenous and captures the effect of BNG price changes on non-BNG prices. The tax and subsidy implications of the required BNG prices for consumers are also examined through the above price system.

Next, the PL and the prices determined from such an extended framework are used to derive aggregate and sectoral private consumption corresponding to plan target on provision of BNG basket for a given percentage of the population. An open Leontief System is then employed to analyse the structure of production implied by the normative consumption targets in the BNG basket. The private consumption and output vectors are derived in the traditional way using a consistent type plan model developed for India (discussed in chapter 1). Thus, in so far as consumption and output blocks are concerned, the basic structure of the model used in this work is the conventional multi-sector plan model. The extensions we have carried out mainly relates to integrating this traditional structure with an income-price solution of the absorption problem.

An integrated framework as above produces a price endogenous plan model suitable for analysing price and output implications of meeting basic needs. The model structure is presented in Chapter 5, while the empirical use of the model on Indian data is carried out in Chapter 6. For empirical implementation, some of the key behavioural parameters like those in consumption and investment functions are taken from

the Planning Commission. The basic sources of data for estimation of most of the other parameters are the various official statistics. Since the data gathered from various sources often turn out to be inconsistent, we have prepared a consistent structure of the Indian economy for 1984-85 and derived coefficients relating to intermediate inputs, labour, imports, taxes and markups etc. The details on data are given in Chapter 6 and Appendix.

For the illustrative empirical use, targets on BNG basket are set for two terminal years: 1989-90 and 1999-2000 with 1984-85 as the base year of the plan. The two terminal years are intertemporally linked through an investment function. The ultimate plan target is fixed for provision of a balanced diet basket for almost the entire Indian population by the year 1999-2000. An interim target is set for the year 1989-90. Some of the main issues examined in Chapter 6 are:

- (a) price structure required to induce consumers at the PL to adopt normative consumption pattern in rural and urban areas;
- (b) tax and subsidy implications of the required consumers' prices.
- (c) income, consumption and production implications of meeting basic food needs under several scenarios relating to redistribution, intermediate targets, post terminal conditions and import substitution.

Finally, in Chapter 7 we summarise the results and make an appraisal of the study.

The study thus attempts to develop a framework of analysis for meeting basic needs and demonstrates the practical applicability of the framework to Indian data. The framework is an extension of conventional input-output based plan models keeping in view the problem of absorption of the basic needs basket by consumers. So far as consumers have freedom to choose their consumption pattern, the income-price strategy advocated here to solve the absorption problem provides 'inducement' for a normative consumption pattern. The empirical results show broad magnitudes of changes required in price structure and production pattern to satisfy basic food needs in India.

Chapter 1

SURVEY OF PLAN MODELS

A large number of plan models have been developed in India over the last four decades. These models reveal a systematic chronological evolution from application of simple techniques to complicated ones in the areas of development planning. The techniques range from Harrod-Domar type of equations in 'simple decision models' to Leontief type inter-industry consistency analysis and optimisation procedures involving linear programming. While such basic techniques themselves were not new discoveries by the plan model builders, the innovative features of the plan models lie in application of these tools to tackle various problems in macro level planning for economic development. It is in this important respect of economic modeling and analysis that several well known contributions have been made in India. The process of application, of course, led to not only modifications of the conventional tools but also integration of the individual tools used for specific aspects of the overall planning problem.

1.1 Evolution of Indian Plan Models

The first identifiable Indian plan model is implicit in the First Five Year Plan document prepared by the Government of India in 1951. It examines achievable growth rate for national income using a variant of the Harrod-Domar (H-D) growth model

$$(1) \quad g = s/k$$

where g = growth rate in national income

s = average savings rate in the economy

k = incremental capital-output ratio (ICOR)

However, unlike the H-D model, the First Plan model assumes savings rate on the margin to be higher than that on the average (see, Bhagwati and Chakravarty, 1969). Hence, its growth rate does not remain constant as in the H-D model but rises over time. Mahalanobis (1961) also makes use of such a model with the H-D assumption of constant average savings rate. A point to note is that H-D use equation (1) to describe the movement of an economy with s and k as parameters. In the planning application, this equation provides an operational frame where s is a decision variable to be used as an instrument by the planners. Since the H-D type equation provides a basic minimum macro consistency condition, all plan models must satisfy it in one form or other if only as a check on feasibility of aggregate growth target from the angle of financial resources. Several simple generalisations of the H-D equation can be made incorporating different propensities to save by income categories, Cobb-Douglas type production function, and two-gap problem of domestic or foreign resource constraint (see, Taylor, 1975 for a discussion).

The two sector model developed by Mahalanobis (1953) gives the rationale for the heavy industry oriented plan strategy followed in the Second Five Year Plan. It is an elegant exposition of growth in consumption and income in a closed economy with non-shiftability of capital. The choice problem Mahalanobis considers relates to allocation of total investment between two sectors, one producing consumer goods

(c) and another producing capital goods (k). The total investment I_t is divided by proportions p_c and p_k between the two sectors ($p_c + p_k = 1$). Assuming one period lag, we have :

$$(2) I_t - I_{t-1} = p_k \cdot b_k \cdot I_{t-1}$$

$$(3) C_t - C_{t-1} = p_c \cdot b_c \cdot I_{t-1}$$

where I_t and C_t are the capacity output levels of the two sectors in time period t and b is the inverse of the ICOR (incremental output per unit of investment).

These two structural equations give the following solutions:

$$(4) I_t = I_0 (1 + p_k \cdot b_k)^t$$

$$(5) C_t = C_0 + I_0 (p_c \cdot b_c / p_k \cdot b_k) \cdot [(1 + p_k \cdot b_k)^t - 1]$$

$$(6) Y_t = I_t + C_t = Y_0 + I_0 [(p_k \cdot b_k + p_c \cdot b_c) / p_k \cdot b_k] \cdot [(1 + p_k \cdot b_k)^t - 1]$$

The Mahalanobis model shows that the larger the proportion of total investment allocated to capital goods (p_k), the higher is the asymptotic growth rate in income and consumption ($p_k \cdot b_k$). Also, if b_c is higher than b_k , a proportionately larger investment to capital goods sector implies a lower growth in immediate consumption and income. It thus throws light on the likely conflict between short (or medium) term and long term growth rates.

The First Plan model emphasises on the necessity to raise savings for growth. It involves an implicit assumption that there are no 'structural' difficulties in transforming savings into physical investment. The Second Plan model as developed by Mahalanobis, on the other hand, focuses on the physical aspect of investment by assuming that investment is limited by domestic production of capital goods under the closed economy assumption. It implicitly assumes that there

are no institutional constraints in generating savings necessary to finance investment. Such an assumption is implicit in almost all the models developed later in India.

The next phase in evolution of the plan models led to development of computable multi-sector models. The programming models developed by Frisch in 1955 and Sandee in 1959 (both published in 1960) constitute two pioneering attempts on an experimental basis. Frisch provides one of the first frameworks incorporating the idea of using linear programming techniques for national planning subject to satisfaction of linear constraints on material balance, though he leaves unfinished the numerical exercises. His objective function is a linear combination of additional employment (U), rate of investment (V) and increase in net foreign assets (F) .

$$(7) \quad \text{maximise } z = w_1 U + w_2 V + w_3 F$$

These variables are in turn related to activity levels. Although Frisch derives the weights (w) through some subjective and controversial reasoning, the idea of multiplicity of social objectives and the explicit recognition of possible tradeoffs among them is of considerable appeal to decision makers.

Sandee (1960) succeeds in getting numerical solutions for a 13 sector optimising model. He assumes fixed technological coefficients with regard to current and capital inputs except for agriculture, where he prefers a linear production function with fertilisers, irrigation and extension as inputs. Assuming linear growth path in consumption and investment over the plan period, Sandee maximises consumption in

the target year in incremental form over the base year subject to conditions on inter-industry balances and trade account feasibility.

A number of models have been built within the consistency framework during the sixties at the Indian Statistical Institute (ISI), Delhi and the Perspective Planning Division (PPD) of the Planning Commission. With assumptions close to those of the official plans, they aim at providing guidelines for quantitative projections and policy analysis over medium or long term spanning over 5 to 15 years. Such models include the ones developed by PPD (1962), Manne and Rudra (1965), and Srinivasan, Saluja and Sabharwal (1966) and are concerned with projection of principal components of domestic expenditure and derivation of a consistent set of sectoral outputs. These are terminal year models and do not specify the time path of the economy from the initial year to the terminal year.

Around the same time, intertemporal optimisation models providing complete time path and phasing of investment have been developed by Chakravarty, Eckaus, Lefebvre and Parikh (CELP) (see, Chakravarty and Lefebvre, 1965 ; Eckaus and Parikh, 1968). Their 11 sector model covers five years of the Third Plan and maximises discounted aggregate consumption over the five year period. An earlier paper by Chakravarty and Eckaus (1964) outlines the logic of an intertemporally consistent multisectoral plan model without numerical experimentation.

Some policy models deal with foreign and domestic

resource constraints through sensitivity analysis. Weisskopf (1967, 1971) examines alternative patterns of import substitution through a model that permits choice between production and imports according to comparative cost criteria. His model belongs to terminal year optimisation category with predetermined targets in final demand. Most of the plan models are of 'open-loop' type with an implied assumption in the Mahalanobis tradition that domestic financial resources do not pose any constraint if it is possible to procure the physical resources. Tendulkar (1971) deviates from this assumption. He explicitly recognises domestic savings constraints by considering savings functions of two functional income earning classes - wage earners and profit earners.

Since the Fifth Five Year Plan (1973-78), the Indian Planning Commission uses terminal year consistency type models for setting official plan targets. The Fifth Plan model (PPD, 1973) is a modified version of the semi-official model built earlier (PPD, 1962). The Sixth Plan (1980-85) and Seventh Plan (1985-90) models (PPD, 1981 and PPD, 1986) are further extensions of the Fifth Plan model.

Of all these models, only a few incorporate the basic need objective in the form of setting targets for a minimum level of living to a specified target group of the population. The PPD (1962) document, which remained relatively unknown till its reproduction in Srinivasan and Bardhan (1974), has played a pioneering role in this respect. The poverty alleviation objective has been integrated with aggregate consumption and its distribution in the official plan models in more or less the same fashion as in PPD (1962).

These models have several characteristics common with other consistency models like that of Manne and Rudra (M-R). We discuss below the main technical features of this class of multisector models with some references to other models.

1.2 Structural Details

The official or semi-official models developed by PPD start with an exogenously specified maximum feasible growth rate in national income and obtain terminal year aggregate consumption and investment using macro relations. The sectoral breakdown of consumption is worked out either through Engel elasticities or through more general demand functions. A Leontief input-output (I-O) system is then used to arrive at sectoral production structure.

Macro Relations

The Fifth Plan model explicitly shows the macro relations. The main equations (omitting certain details like composition of indirect taxes) are the following:

$$(8) \text{ GDP}^t = Y^0 (1+r)^t + \text{TIND}^t$$

$$(9) \text{ GDP}^t = C^t + G^t + I^t + E^t - M^t$$

$$(10) I^t = I^0 + B^{t,t}$$

$$(11) I^* = \sum_{t=1}^5 I^t = k (\text{GDP}^5 - \text{GDP}^0)$$

Where

Y = gross domestic product at factor cost

GDP = gross domestic product at market price

C = total private consumption at market price

G = total government consumption at market price

I = total capital formation at market price (including inventories)

E = total exports at f.o.b.

M = total imports at c.i.f.

TIND= total indirect taxes

Growth rate r in Y over the plan period is determined exogenously on consideration that the volume of resources needed for achieving this growth rate is the same as (or no more than) the total resource availability estimated independently of the plan model. The corresponding target year Y along with total indirect taxes gives estimate of GDP. Total investment over the entire five year period of the plan (I^*) is obtained by applying capital-output ratio (k) on incremental GDP in target year over base year. The parameter B^t in equation (10) indicates the annual rate of investment phasing and is chosen so that total investment over 5 years equals that estimated by (11). Government consumption (G) and exports (E) are specified exogenously (a common feature in almost all plan models) and imports (M) are determined in the I-O block discussed below. Now, with I given from (10), private consumption (C) in the Fifth Plan model is determined as a residual from the income-expenditure macro balance (9).

In some other models (e.g., PPD, 1962) terminal year private consumption is exogenously specified as a target variable and the model determines the required GDP growth rate.

Input-Output Specification

A terminal year Leontief type I-O model in its 'open-loop' version lies at the core of multi-sector official plan models in India. The commodity balance equations in this accounting framework are:-

$$(12) \quad X_i = \sum_{j=1}^n a_{ij} X_j + C_i + G_i + I_i + \Delta S_i + E_i - M_i$$
$$= \sum_{j=1}^n X_{ij} + F_i - M_i, \quad i=1,2,\dots,n.$$

The total supply of the goods produced by a particular sector i equals all categories of demand for that good. Supply consists of gross domestic production (X) plus competitive imports (M). Demand consists of intermediate demand from all sectors and final demand (F). The notations for the various forms of final demand are as earlier in equation (9) except that I now refers to only fixed investment and stock changes (ΔS) appear separately.

A standard assumption is that the I-O coefficients remain constant in the sense that they do not change in response to changes in the endogenous variables of the plan model. Some exogenous changes are, of course, often made in the input coefficients estimated from a base year data set on the basis of likely future input structure. With the constant coefficient assumption, (12) may be written in matrix form as:

$$(13) \quad (I-A) X = F-M, \quad \text{or}$$

$$(14) \quad X = (I-A)^{-1} (F-M)$$

which gives the solution of an internally consistent vector of sectoral output levels given a forecast of the net final demand vector.

The treatment of different components of final demand differs from model to model. Government consumption and exports are exogenously specified in most of the plan models on considerations of trend growth rates and expected policy changes over the plan period. Some policy models, however, impose upper and lower bounds on them and even carry out variational exercises (e.g. sensitivity on exports in the import substitution model of Wiesskopf). Frisch (1960) assumes exports and government consumption of various sectors to be fixed proportions of the corresponding totals. It is only in a few cases (e.g. Chenery, 1955) that exports are related to ratio of domestic production cost to export earnings.

Imports

Treatment of imports have varied a great deal in different models. Normally distinction is made between two types of imports: competitive and non-competitive. Competitive imports, in principle, refer to those imports which could be produced within the country (during the plan period) and may be substituted by domestic production and as such a problem of choice between the two arises. Non-competitive imports, on the other hand, consists of domestically non-producible imports needed for the production process and imports of the 'complementary' type.

Non-competitive material input imports are normally linked to output levels through fixed proportions:

$$(15) \quad M^{nc} = [a_0] \times$$

Where M^{nc} and X are noncompetitive imports and output vectors, and $[a_0]$ is a diagonal matrix showing intermediate imports-output ratios along the main diagonal. In some cases, as in M-R model, 'competitive' imports are also treated as fixed proportions of output. Rudra (1975) raises a question regarding appropriateness of labelling such imports as 'competitive', because the fixed proportion assumption means that these imports cannot be substitutes for domestic goods. He says these may better be called 'complementary' imports 'arising out of certain desired product mixes'.

A more elaborate treatment of imports occurs in the Fifth Plan model in the following way:

$$(16) \quad M_i = \sum_{j=1}^n (m_{ij} - d_{ij}) X_j + c_i \cdot C_i + g_i \cdot G_i + b_i \cdot I_i$$

where

m_{ij} = imported input of sector i per unit of output of sector j ,

d_{ij} = extent of reduction in m_{ij} due to import substitution,

c_i, g_i, b_i = proportions of good i coming from imports in private consumption, public consumption and investment respectively.

There is clearly no scope for competitive imports in the above equation. This may not pose much problem in a consistency model which is not suitable to handle the question of choice anyway.

The choice question is relevant in the optimising models. Authors of the CELP model, thus, determine levels of

competitive imports by the optimising mechanism of the model. However, in order that the model does not produce unacceptable extreme solutions like allocating available foreign exchange to only one or two sectors, they impose upper bounds on competitive imports of each sector:

$$(17) \quad M_i^C \leq m_i (E + A - \sum M_i^{NC})$$

Total foreign exchange (exports and aid) is first used to finance essential non-competitive imports and the rest is allocated to competitive imports of different sectors with upper limits m_i on the allocation proportions.

Investment

As discussed earlier, the macro relations in the Fifth Plan model determine the total plan investment using an overall ICOR and the terminal year investment is computed through a step function showing phasing of total plan investment over different years during the Plan period. The terminal year total investment is broken down into various delivery sectors using exogenously given proportions. This method of treatment implies that the volume of investment and its composition are independent of the structure of output.

M-R specify investment in two different ways. In one version, it is specified exogenously. In the other version, it is endogenous in the following way:

$$(18) \quad I_i = d \cdot \sum_{j=1}^n k_{ij} (X_j^T - X_j^0)$$

Investment here is related to output increase over the entire plan period. The parameter k_{ij} indicates amount of good i needed as fixed capital for producing j th good at unit

level and is used to compute total plan investment requirement of i th type of capital good. The terminal year investment is then determined as a proportion of total plan investment through a stock-flow conversion factor d . Under the assumption of a constant gestation lag (l) for all sectors and a constant exponential rate of growth in investment (r) over the plan period ' d ' is obtained as:

$$(19) \quad d = e^{rT} / \int_{-l}^{T-l} e^{rt} .dt = r.e^{rT} / (1 - e^{-Tr})$$

A similar procedure of linking terminal year investment to cumulated investment over the plan has been followed in the earlier work by Sandee, who assumes investment to increase linearly over time, instead of exponentially as in case of M-R.

In their dynamic intertemporal models the CELP group experiments with great detailed specifications of investment focussing on the future productive capacity generation aspect. They distinguish between investment demand for new capacity creation and that for replacement of capital stock. They assume a three-year structure of gestation lag so that investment demand in year t depends on increase in capacity (output) in year $t+1$, $t+2$ and $t+3$. The current flows of i th investment goods for new capacity creation is given by :

$$(20) \quad N_i^t = \sum_{k=1}^3 \sum_{j=1}^n k_{ij}^k . Z_j^{t+k}$$

where Z_j^t is addition to capacity in sector j in year t and k_{ij} quantity of investment good i required per unit capacity increase in sector j . A similar specification is adopted for replacement investment too. In some versions the authors

assume that each sector grows post-terminally at the annual sectoral growth rate r_j implied by X_j^T and X_j^0 so that constraint on capacity (K) takes the form

$$(21) \quad K_j^{T+1} \geq k_j (1 + r_j)^{l_j} X_j^T$$

The data base for estimation of the capital coefficient matrix often happens to be very weak. The easily available company balance sheet data providing book values of capital relates to past prices and often obsolete technology. Another source - more relevant and often used - refers to project reports of current investment projects. Such reports, however, may not be available in adequate number. As Rudra (1975) notes, the capital coefficients computed with data from this source in the sixties were based on too small samples and had 'large margins of error'. The Sixth Plan exercise (PPD, 1981) explores the possibility of using time series capital formation data available in the National Accounts Statistics, which give data only by two types of capital goods: (a) machinery and equipment, and (b) construction. An advantage here is that the parameters are estimated through econometric functions assuming different values of time lag and the one giving best fit is chosen.

In the Sixth Plan model, replacement investment is related to sectoral output by fixed coefficient. Net investment is considered through sectoral capital-output ratio (k_j) with different gestation lag for different sectors (l_j). Assuming equal disbursement of investment over the gestation period, one may write net investment demand for j th sector of destination as

$$(22) \quad U_j^T = (k_j / l_j) [(1 + r_j)^{l_j} - 1] X_j^T$$

where r_j is post terminal growth rate in output of sector j . The link between investment by destination (U_j) and that by origin (I_i) is given by

$$(23) \quad I_i^T = \sum_{j=1}^n b_{ij} U_j^T$$

where the distribution coefficient b_{ij} indicates proportionate share of i th capital good producing sector per unit of investment in j th receiving sector.

Lastly, turning to inventory investment, in some of the models such investment over the entire plan period is related to incremental output over the same period and the terminal year investment is then determined using the stock-flow conversion factor. In the official models, it is related to output of the current period, at times subject to some given total stock changes.

Private Consumption

Private consumption is the most dominant component of the final demand vector accounting for two-thirds or even three-fourths of final demand in most of the consumer goods' sectors. Hence, projection of output structure, would greatly depend on determination of the private consumption vector. In some of the models, where GDP growth rate is specified as a target, aggregate private consumption may be determined from macro relations as discussed earlier. A multi-sector plan model in this case determines the sectoral composition of private consumption.

In some of the optimising models, on the other hand, the objective function is stated as maximisation of discounted sum of private consumption over the plan period. While the model generates the optimum level of consumption, its composition is assumed to be fixed in the CELP model. To state formally :

$$(24) \quad \text{maximise} \quad \sum_{t=1}^T W(t) C(t)$$

where $W(t) = (1 + r)^{-t}$ and $[c] C(t) \leq F(t)$

where r is social discount rate and $[c]$ is diagonal matrix of consumption proportions with $\sum c_i = 1$. Given this assumption, only the scale of consumption of the composite good is determined by the solution of the optimising mechanism. The fixed proportionality assumption for private consumption is indeed very restrictive, because it implies that income elasticities of consumption do not differ from commodity to commodity (Srinivasan, 1965).

The most commonly used, though not always satisfactory, method of determining commodity composition of consumption is through the use of constant elasticities of demand:

$$(25) \quad (C_i^t / N^t) = c_{i0} (C^t / N^t)^{e_i}$$

where C_i^t = consumption expenditure on commodity i in time t

C^t = total consumption expenditure on all goods and services in time period t .

N^t = Population in time t

e_i = Engel elasticity for commodity i

c_{i0} = a constant

The above equation states that the per capita consumption expenditure on commodity i depends on per capita total consumption expenditure. In particular, it implies percentage change in per capita demand for commodity i equals percentage change in total consumption expenditure multiplied by the Engel elasticity

$$(26) \quad (\Delta C_{it} / C_{i0}) = (\Delta C_t / C_0) \cdot e_i$$

A problem with the use of Engel elasticity is that the adding up condition may not be satisfied i.e. the sectoral demand projections may not add up to the total. To guarantee the adding-up condition, the Engel elasticities should satisfy the condition

$$(27) \quad \sum_{i=1}^n e_i (C_i / C) = 1$$

The loglinear function is simple and convenient but has unsatisfactory features. The implied constant elasticity contradicts the fact that for most commodities, elasticity tends to decline as income or total consumption expenditure increases. The function also passes through the origin, which is not a desirable feature in a consumption function.

M-R use Engel curves estimated from cross-section data along with $g(c)$, the density function for frequency distribution of households by per capita total expenditure c . The parameters of $g(c)$ for base year 0 are estimated from available NSS data. Given plan targets on growth and distribution of consumption, one may obtain $g(c)$ for the target year.

The consumption demand for specific item i is :

$$(28) \quad C_i^T = N^T \int_{-\infty}^{\infty} g^T(c) \cdot D_i(c) \cdot dc$$

where $D_i(c)$ represents cross section demand function (Engel curve) for commodity i .

The question now is: under what conditions will (28) reduce to (26)? Rudra (1969) mentions the following two conditions:

- (i) $D_i(c)$ has log linear form
- (ii) $g^T(c)$ and $g^O(c)$ have the same Lorenz ratio, though different mean. This would mean consumption of all fractile groups would increase by the same factor.

Empirical evidence on Indian data shows that $g(c)$ has a lognormal form specified by mean μ and standard deviation λ . An advantage in the use of two parameter lognormal distribution is that the Lorenz ratio is a monotonic function of λ only.

Now, so far as plan models incorporating the basic needs objective in terms of poverty line PL are concerned (PPD, 1962 and the official models), an important feature relates to consistency between the stated BN objective, the aggregate private consumption and its size distribution. Let C_p be the PCE of the poor, i.e. the lowest p proportion of the population. Suppose the plan objective is to raise C_p upto PL. The following relations may now be employed to achieve the required consistency:

$$(29) \quad \Phi(Y_p) = p$$

$$(30) \quad \Phi(Y_p - \lambda) = q$$

$$(31) \quad q = p \cdot (c_p / c)$$

where $\Phi(t)$ = area in standard normal curve from $-\infty$ to t , and Y_p = point in abscissa of standard normal distribution corresponding to consumption level PL. Now, one approach followed by PPD (1962) is to exogenously specify λ (or L) and get PCE of the entire population c . Given p and PL ($=c_p$), we may compute Y_p , q and c from the above equations. Note that q is share of the poor in aggregate consumption. Another approach adopted by the official plan exercises (PPD, 1973) is to start with c given from the macro relations and use the above equations to determine inequality parameter λ (Equations (29) and (31) are used to get Y_p and q respectively; then, (30) is employed to determine λ).

1.3 Use of Linear Expenditure System

In the cross section demand function of the Engel curve type, consumption demand for a specific item is a function of income (or total consumption expenditure) alone. Definite improvements in estimation of demand functions have been made by a Task Force of the Planning Commission (PPD, 1979) whose parameter estimates have been used by the Sixth and Seventh Plan models. Demand projections are made in two stages in these exercises. First, all commodities are grouped into 16 broad groups and demand for these groups are projected considering the Linear Expenditure System (LES). Secondly, best fitting Engel curves are employed for different finer commodity sub-groups covered in each LES group and their demand levels are projected subject to LES totals. Experiments with LES on Indian data had, however, been made earlier in the sixties (Paul and Rudra, 1964; Joseph, 1968). Although the

estimated parameters had not been used directly by a plan model as such, these were nevertheless used in a plan related exercise by Rudra (1967) to investigate balance in growth rates estimated by the Plan documents for the decade 1961-70.

The LES developed by Stone (1954) specifies expenditure on each commodity group as a function of income or total consumption expenditure (y) and prices (P) of all groups. The system is expressed as

$$(32) \quad p_i q_i = p_i q_i^* + b_i \left(y - \sum_{j=1}^n p_j q_j^* \right), \quad i=1,2,\dots,n$$

where $b_i > 0$, $\sum_{i=1}^n b_i = 1$

Here, q_i is quantity of consumption of i th good and p_i its price. The parameter q_i^* is interpreted as committed quantity of consumption purchased irrespective of prices. The other parameter b_i is a marginal propensity to consume and indicates the proportionate share of i th good in total consumption in excess of all committed consumption.

The LES is a complete demand system maximising the Stone-Geary type log linear utility function subject to budget constraint. The system possess, inter alia, the property of additivity i.e.,

$$(33) \quad y = \sum_{i=1}^n p_i q_i$$

Since $b_i > 0$, the system cannot accommodate inferior goods. PPD (1979) estimated LES parameters by applying Newton-Raphson method to time series of cross section data obtained in various rounds of NSS consumer expenditure surveys spanning over the period 1961-62 to 1973-74. The need to use time-

series data based demand functions for macro demand projection has been recognised for long. Parameters of such demand functions reflect some essential characteristics of the growth process and are preferable for plan projections. In this sense, the Sixth Plan model represents a definite improvement.

Dividing (32) by p_i one gets

$$(34) \quad q_i = q_i^* + (b_i/p_i) \left(y - \sum_{j=1}^n p_j q_j^* \right) \\ = q_i^* + b_i \sum_{j=1}^n (p_j/p_i) (q_j - q_j^*)$$

This shows that quantities demanded are linearly related to each other, given the relative prices. Dividing (32) by q_i we get

$$(35) \quad p_i = p_i (q_i^*/q_i) + b_i \sum_{j=1}^n ((q_j - q_j^*)/q_i) p_j$$

This shows that one may determine prices, given quantities of demand in absolute magnitude.

Rudra (1967) uses LES to investigate the extent to which agriculture acts as a constraint on industrial growth and to compute the magnitude of price and foreign exchange pressures that may be generated if the growth process happens to be unbalanced. Since he intends to measure the price-effects of a supply constraint situation, it is necessary to employ a demand function involving prices in addition to income. The LES becomes a convenient tool for this purpose and it is integrated with the I-O system to study the demand-supply balance.

The study uses 3 aggregative sectoral classification scheme. It is a terminal year model and the notion of balance refers to the terminal year. To study the 'balanced growth'

pattern, Rudra assumes relative prices in target year to be the same as those in base year. This helps him to get two independent linear relations involving q_1 , q_2 and q_3 , the per capita quantities of consumption. Substituting the corresponding total private consumption values in the commodity balance equations, one may derive a relationship between output, net exports and other exogenously given final demand elements. Then it is possible to produce balanced combinations of rates of growth for the three sectors and to calculate foreign exchange effects of unbalanced growth.

In order to predict price effects of 'unbalanced' growth, the steps are followed in the reverse direction. Given output and exogenous components of final demand, commodity balance equations yield total private consumption. The corresponding per capita consumption values are then used in LES to calculate relative prices.

Since the purpose of Rudra's exercise was to use LES once to predict quantity demanded at given relative prices (for the balanced growth consideration) and another time to predict prices with given quantity of supplies (for price effects of imbalanced growth), he estimates the parameters in two different ways. In the first case the expression

$$(36) \quad \sum_{t=1}^T \sum_{i=1}^n \{q_{it} - q^*_i - b_i \sum_{j=1}^n (p_{jt}/p_{it}) (q_{jt} - q^*_j)\}^2$$

is minimised for variations in b_i and q^*_i . This he calls quantity fit. In the second case the expression

$$(37) \quad \sum_{t=1}^T \sum_{i=1}^n \{p_{it} - (q^*_i/q_{it}) p_{it} - b_i \sum_{j=1}^n p_{jt} (q_{jt} - q^*_j)/q_{it}\}^2$$

is minimised for variations in b_i and q^*_i . This he calls

price fit. As the following table shows the estimated values of the parameters, however, do not differ much between the two fits.

Estimates of LES Parameters by Rudra (1967)

<u>Commodity class</u>	<u>Quantity fit</u>		<u>Price fit</u>	
	q^*_i	b_i	q^*_i	b_i
Foodgrains	6.00	0.355	5.85	0.364
Other food products	4.34	0.302	4.23	0.297
Non-food products	4.98	0.343	4.86	0.339

1.4 Prices in Multi-sector Models :

Multi-sector plan models are typically concerned with the real variables by focussing on final demand and output. A few plan models, however, consider price determination rules and endogenous response of some real variables to price changes. The I-O system has got a price counterpart where unit prices (P_i) are expressed as cost of intermediate inputs and factor payments :

$$(38) \quad P_i = \sum_{j=1}^n a_{ji} P_j + V_i, \quad \text{or}$$

$$(39) \quad P_i = \sum_{j=1}^n a_{ji} P_j + w_i l_i + r_i k_i$$

where V_i = value added per unit of output

l_i = labour-output ratio

k_i = capital-output ratio

w_i = wage rate per unit of labour

r_i = rent and profit per unit of capital

If A' denotes transpose of the I-O coefficient matrix A , we may write the above equations in matrix form as

$$(40) \quad P = (I - A')^{-1} V, \quad \text{or}$$

$$(41) \quad P = (I - A')^{-1} ([l] W + [k] R)$$

where $[l]$ and $[k]$ are diagonal matrices of labour-output ratios and capital-output ratios. Goods prices are thus expressed in terms of factor prices. An alternative formulation is to treat cost of capital in multiplicative rather than additive form. The intermediate material cost and wage bill together constitute the prime or variable cost. The unit prime cost is then inflated by a markup rate to get price following Kaleckian tradition. The price formation rule is then expressed as

$$(42) \quad p_i = \left(\sum_{j=1}^n a_{ji} p_j + w_i l_i \right) (1 + T_i)$$

Price equations of the above kind in one variant or the other often track observed prices fairly well under normal conditions (Ghosh, 1964; Watanabe and Shishido, 1970). Given the linear technology and the mark-ups, the cost based prices are independent of the level and structure of final demand. These price equations also neglect the speculative elements which may have significant impact on prices in abnormal conditions like war or natural calamities. In these conditions the I-O models may fail to provide efficient tracking ability.

The cost based price equations have been used in multi-sector models for price projections. One of the first to use this methodology for numerical computations was Johanson(1960) in his exercise on multi-sectoral growth projections in some more general form by separately considering the cost of non-competitive imports, depreciation allowance and indirect tax rate. While retaining the I-O tools for current input demand, Johanson allows for possible substitution between labour and capital depending on their relative prices.

Such price systems have been adopted by many Indian studies, some recent ones being Sarkar and Subbarao (1981), Taylor (1983), Gupta and Srinivasan (1984), Jha and Mundle (1987). Some of them incorporate wage-price interaction by making wages dependent on prices of consumer goods. Such interactions are normally more relevant particularly for the organised sectors where there are institutional mechanisms linking wages to consumer price index number. The mark-up rate, on the other hand, is often assumed to be fixed exogenously. An alternative hypothesis is that mark-up rate varies directly with excess demand conditions. This can be captured by relating mark-up to level of capacity utilisation. This relation helps to introduce a feedback mechanism from the real block to the price block in some computable general equilibrium (CGE) models in the structuralist tradition (see, Taylor, 1983; Panda and Sarkar, 1990 for such models developed for India). With the I-O quantity (closed loop version) and price systems at their core, these models are very similar in structure to a plan model.

Another class of CGE models developed in the tradition of Adelman and Robinson (1978), also evolve from a closed I-O quantity system. A distinguishing character of this class of models is that all factor and commodity markets are cleared by their respective prices. Since the set of equations is homogeneous of degree zero in wages and prices, such CGE models determine only relative prices. If product prices are given, there are as many number of equations as number of endogenous variables in the factor market equation system. With the factor prices given, it is necessary to have in the product market equation system one extra equation providing the normalisation criteria to determine the level of absolute prices. While the input-output models or the Taylor type structuralist CGE models are demand constrained, the Adelman-Robinson type models are supply constrained because aggregate supply of primary factors limits output growth.

Lastly, we may draw attention to a price endogenous model by Rudra (1966). Although its focus was on formulation of a frame for decentralised long-term planning, the objectives of the plan were stated in terms of provision of minimum needs of both private and public goods, reduction in inequality and attainment of self sufficiency. In some respects like integration of inequality and aggregate private consumption, Rudra follows PPP (1962) with lognormal distribution assumption for PCE. An interesting feature in Rudra's paper relates to the objective of private consumption in terms of attainment of normative minimum quantities of consumption for certain goods. This was stated as :

$$(43) D_i(C_a, P_1, P_2, \dots, P_n) = q_i, \quad i=1, \dots, m.$$

The demand function D_i is used to ensure that market price of commodities $P_1, \dots, P_n$ and C_a , the PCE of the lowest $\alpha\%$ of the population, will be such as to make the demand for commodity i equal to the normative minimum. By definition C_a is:

$$(44) C_a = \sum_{i=1}^n P_i \cdot D_i(C_a, P_1, \dots, P_n)$$

Rudra uses (43) and (44) to solve for $P_1, \dots, P_m$ and C_a , given prices of non-essential goods P_{m+1} to P_n . In a later stage, the prices P_{m+1} to P_n are determined by a linear programming method with minimisation of foreign assistance over the plan period as the objective function.

Rudra's formulation is important in so far as it recognises that an income-price strategy is necessary to attain normative minimum private consumption targets. By assuming the consumption norms as given exogenously, Rudra, however, ignores the feedback from the prices to the consumption norms. Incorporation of such a feedback process is essential particularly for the food items. A standard procedure to determine the food consumption norms is to operate a linear programming problem that minimises the cost of a food basket satisfying the minimum requirement levels in respect of various nutrients. With changes in prices, the cost conditions change and hence, the norms also should change. Secondly, if one uses a complete demand system that satisfies the adding up criteria, equation (44) will not be an independent one. It would be necessary to introduce one more equation to determine prices ($P_1, \dots, P_m$) and C_a from (43) and (44); for instance, one may put a restriction on the

cost of the normative basket.

To conclude, the Leontief input-output system is at the core of virtually all plan models used to analyse issues of structure of production and investment. The main virtue of such models lies in the fact that they provide a consistent framework for considering policies that affect various interdependent sectors. A major problem with such models is that they are concerned with the real side of the economy ignoring the price variables. It is important to extend the input-output models to incorporate the price variables because certain incentive instruments such as taxes and subsidies could be built into the model system. This would help in proper design of policy tools that work through the market in a mixed economy.

Chapter 2

INDIAN ECONOMIC GROWTH AND THE BASIC NEED GOODS (BNG) INDEX*

In this chapter we make an assessment of the performance of the Indian economy since the beginning of the planning era. In section 2.1 we briefly discuss some key features of the Indian economy relating to growth and distribution in national income and changes in absolute poverty. We then argue that national income is not a good indicator of the performance of the economy in so far as provision of basic needs is the primary objective of planning. In section 2.2 we propose an index called the Basic Needs Goods (BNG) index which is based on production of a small range of essential goods and services. The question of choice of an appropriate set of weights is discussed at some length and two alternative sets are chosen for construction of the BNG index. Section 2.3 deals with the data base for construction of the index. In section 2.4, we then examine India's development experience with the help of the BNG and the conventional GDP indices. Lastly, some concluding observations are made in section 2.5.

2.1 AN OVERVIEW OF GROWTH AND POVERTY

GDP Growth

It is natural to initiate a discussion on the overall performance of an economy by looking at movements in its national income, which is a measure of the volume of aggregate production. Judged by national income growth, the Indian economy has been moving

* This chapter (excluding section 2.1) is a revised and updated version of Panda and Chakrabarti (1981).

on a steady trend growth path since the beginning of the Five Year Plans. Gross Domestic Product (GDP) at constant price has grown at a trend rate of 3.6% per annum over the period 1950-51 to 1986-87. The growth rate has been more or less stable over the various sub-periods with some indications of acceleration since mid-seventies (See, Table 2.1). A large part of the benefit of the overall growth has, however, been offset by population growth of about 2% per annum. The trend growth rate in per capita real GDP is only about 1.5% over the plan period as a whole, though in recent years it has been a little more than 2% per year. The growth performance of the Indian economy has generally been rated as modest, particularly in comparison to that of other developing economies during the post-war years.

Table 2.1
Trend Growth Rate in Real GDP

Period	GDP	Per capita GDP
1950-51 to 1986-87	3.65	1.48
1950-51 to 1964-65	3.85	1.86
1967-68 to 1986-87	3.89	1.66
1974-75 to 1986-87	4.30	2.11

Note: 1. Growth rates are estimated by fitting semilogarithmic functions of the type $\log Y = a + bT$, where Y = relevant GDP and T = time.

2. The years 1965-66 and 1966-67 are excluded from the sub-periods because of very abnormal situation due to two successive droughts, a war with Pakistan and devaluation of rupee.

Income Distribution

An important question that is often asked is whether the benefit of the modest economic growth has percolated to the lower income groups. Income distribution data are not available in India on a systematic time series basis. But data on per capita consumer expenditure (PCE) distribution are available on a fairly comparable basis for a long period from surveys conducted by National Sample Survey Organisation (NSSO). According to the NSSO data, the degree of inequality in size distribution of PCE registered a statistically significant fall in both rural and urban areas during 1960 through 1973 (Dutta, 1980). The NSSO data are at current prices. The question as to whether the inequality reduction has taken place in real terms as well cannot be answered without considering relative price rise faced by various income groups. Some investigators (e.g. Murty and Murty, 1977) have found that the lower income groups experienced a higher rate of inflation than the upper income groups between 1965 and 1973. If so, reduction in Gini-coefficient in nominal terms overstates the change in real terms for this period.

Absolute Poverty

A more direct answer on the question of percolation could be obtained by examining the extent of "absolute poverty". Ahluwalia (1978, 1986) estimates poverty in rural India using two measures: (a) the head count ratio, which refers to percentage of population living below the poverty line; (b) Sen's index (Sen, 1976) which considers not only the number of the poor but the intensity of poverty as well. His finding is that extent of rural poverty declined in the fifties, rose to a peak in 1967-68 and declined further thereafter (See Table 2.2). He does not find any significant upward or

Table 2.2

Poverty Estimates

Year	Percentage of population in poverty		Sen's Index		Total population in poverty (Million)	Percentage of poor
	Rural	Urban	Rural	Urban		
1	2	3	4	5	6	7
1956-57	54.1		0.23			
1957-58	50.2		0.22			
1958-59	46.5		0.19			
1959-60	44.4		0.17			
1960-61	38.9	40.4	0.14	.156	173	39.2
1961-62	39.4	39.4	0.14	.155	177	39.4
1963-64	44.5	42.5	0.16	.161	208	44.1
1964-65	46.8	45.7	0.17		226	46.6
1965-66	53.9	46.4	0.21	.180	234	47.2
1966-67	56.6	48.4	0.24		278	55.0
1967-68	56.5	48.3	0.24	.188	285	54.4
1968-69	51.0	45.5	0.20	.176	264	49.9
1969-70	49.2	44.4	0.19	.168	262	48.2
1970-71	47.5	41.5	0.18	.158	256	46.3
1971-72	41.2					
1972-73	43.1	44.6			280	48.4
1973-74	46.1	38.7	0.17	.130	264	44.6
1977-78	39.1	39.6	0.14		262	40.0
1983	33.2	34.9			245	33.6

Sources: Ahluwalia (1986), Dutta (1980), Tendulkar (1987).

Note: (1) Last column estimated by us using data in Tendulkar (1987).

(2) Poverty line is defined as monthly per capita expenditure of Rs.15 and Rs.20 at 1960-61 prices for rural and urban areas respectively.

downward time trend in rural poverty for the period 1956 through 1977. But there has been large fluctuations in the extent of poverty over time and these are negatively related to agricultural performance. Dutta (1980) reports that movements in incidence of poverty in both rural and urban sectors exhibit common pattern of fluctuations, rising or falling phase occurring together in both sectors.

The Indian economy has been on a steady growth path in terms of aggregate and per capita real GDP growth during the planning era. Income (consumption) distribution has improved slightly indicating some percolation of benefit of growth to the lower income groups. These changes have, however, not been strong enough to cause a significant fall in absolute poverty. Even after about four decades of planning, poverty persists at a high level with atleast one third of the Indian population living below the poverty line. In the following sections, we examine India's performance in the BNG sectors.

2.2 BASIC NEED GOODS (BNG) INDEX

In this section we develop what we call the Basic Need Goods (BNG) index. The conventional national income concepts such as GDP used in the earlier section do not seem to be sufficient for assessing performance of the Indian economy in the sphere of basic need goods.^{1/} There are two main reasons for this. First, the GDP measure

^{1/} The treatment of GDP as a meaningful measure of 'growth' has come to be questioned even in advanced economies in recent years although for different reasons (see, Nordhaus and Tobin, 1971). See also Hicks and Streeten (1979) for a survey of measures supplementary to GDP.

relates to a comparatively amorphous total of 'all goods and services'. It may happen that in a particular year national income shows significant rise because of substantial provision of luxury goods or 'regrettable necessities' like defence or law and order, while there is little or no increase in provision of essential consumer goods. In so far as success in provision of basic needs is to be judged, the appropriate yardstick should be based on basic need goods and services. Secondly, in the GDP measure, which gives aggregate value of all goods and services, market prices are used as weights - a car costing one lakh rupees being given a thousand times greater weight than a quintal of wheat costing one hundred rupees. Such use of the price structure as weights for the BNG basket is not conceptually satisfactory because relative prices need not reflect the relative basicity of BNG items.

Our objective for construction of the BNG index is two-fold: (1) to take into account only a range of consumer goods which qualify as BNG, and (2) to use a weighting system that reflects the relative basicity of the goods considered.

A simple way to judge progress in provision of BNG basket might be through consideration of the market value of the basket $\sum P_i X_i$ where P_i = price of i^{th} good, X_i = production of level of i^{th} good, and i ranges over the items considered in the BNG basket. Prices here serve two purposes : (a) weighting the different items, and (b) translating the heterogenous basket into a common dimension. If we eschew the use of prices and use a set of pure numbers w_i as weights, ($\sum w_i = 1$), the sum $\sum w_i X_i$ will be a meaningless quantity. However, we can still construct a meaningful index of change in the

production of these goods, through weighted aggregation of the index numbers of physical production of the goods with a common base year. We thus define the BNG index as:

$$(2.1) \quad \text{BNG}_t = \sum_i w_i q_{it}$$

where q_{it} = index of physical production of the i^{th} basic need good in year t in per capita terms

w_i = weight attached to i^{th} good (discussed below)

An index of this kind enables us to make a comparison between BNG basket at different dates, although it does not help us to measure the absolute size of the basket at any date. We use above per capita output rather than aggregate output because the index is intended to measure success of the community in providing basic needs to all its members.

The BNG index may be interpreted as an index, in some sense, of potential per capita welfare of the community, measured in terms of satisfaction of basic needs. It is potential because the index proposed here is an aggregative index that leaves out the distribution factor. The weight w_i can then be viewed as a measure of the relative contribution of the i^{th} good or service to aggregate welfare. A value judgement that non-basic consumer goods have zero welfare weight will perhaps be quite generally acceptable in a situation of widespread absolute poverty. The index as defined also gives zero weight to the production of capital goods. Capital or intermediate goods need not be viewed as end by themselves, but as means of producing other goods. Their performance should ultimately be judged by the BNG sector.

Turning next to the question of choosing an appropriate weighting system, one position may be that the weights should all be equal; that once we recognise some needs as 'basic', there is no ground for further ordering them as more or less basic. It is not easy to refute such an argument on a priori grounds, given some exogenous listing of basic need items. However, assigning equal weight to all items - e.g., treating clothing to be as important as food - does not intuitively appeal to us as a right procedure.

Another procedure would be to choose weights in proportion to the percentage shortfall of actual per capita production from some absolute minimum standard constructed on the basis of some physiological or other norm. For example, suppose that the desired minimum quantity or norm of food (per capita per year) is 200 kg. and of clothing, 20 meters. Let the actual production in the benchmark year per capita be 150 kg. of food and 10 meters of cloth. Then the shortfall from the standard is 25 per cent in case of food and 50 per cent in case of cloth. According to the criterion under discussion, the proportion between the weights attached to food and clothing should be 25:50 i.e., 1:2. A weighting procedure of this type is used by Drewnowski and Scott [1966, Section 1.4] in the construction of an index of level of living.

Despite its intuitive appeal, there are difficulties in employing this weighting procedure. First, it will be difficult to fix up the absolute standards; indeed, for all items other than food, the norm or the standard set up is likely to be essentially arbitrary. Secondly, the logic of the procedure requires that weights be changing over time. When the weight of some basic need good falls

to zero, it will disappear from the index.^{1/} The fact that the community has succeeded in achieving the target or the norm for this commodity will not be reflected in the index in any way. The index will thus reflect failure more than success or achievement. Thirdly, this procedure also essentially treats all the basic needs as equally basic. This is so because if the percentage shortfall in respect of one commodity is twice as much as that of another, it gets twice as high weight, irrespective of the nature of the commodities. The community, however, may accord different degrees of importance to different goods. The greater shortfall in the production of one basic need good relative to another may, in such a case, be a consequence of the relatively smaller importance attached to it by the community.

Once it is accepted in principle that goods are basic in different degrees, it is natural to look for guidance on their relative 'basicity' in household preferences as expressed in household consumption behaviour. Following this line of approach, one possible weighting system is to take the weights as proportional to the budget shares of the commodities (for all consumers or for a particular class of consumers). However, the difficulty with this system is that the weights are similar to those in a GDP index and relative prices significantly affect them. In a two-commodity economy, the budget shares (weights) w_1 and w_2 may be written as:

^{1/} The item for which the norm has been achieved does not disappear in the particular variant considered by Drewnowski and Scott, but it gets the minimum weight.

$$(2.2) \quad w_1 = \frac{q_1}{q_1 + (\frac{p_2}{p_1})q_2} \text{ and } w_2 = \frac{(p_2/p_1)q_2}{q_1 + (\frac{p_2}{p_1})q_2}$$

which directly depend on relative price, $\frac{p_2}{p_1}$.

A weighting system which does not involve prices can, however, be built up from the budget shares. Consider a class of high income households 'h' and another class of low income households '0'. The weight of a commodity 'i' may be taken as:

$$(2.3) \quad w_i = \frac{S_{0i}}{S_{hi}} / \sum_i \frac{S_{0i}}{S_{hi}} = r_i / \sum_i r_i, \text{ say}$$

where S_{0i} and S_{hi} denote the budget share of commodity 'i' for the two income groups (in the 'base' or 'benchmark' period). Since the weights are intended to measure the relative 'basicity' of different basic need goods, it will be appropriate to define the budget shares as shares in total expenditure on basic need goods only and not on all items of consumption.

That the above ratios of budget shares do not involve prices in a significant way can be seen in the following way. Consider r_i :

$$\begin{aligned} (2.4) \quad r_i &= \frac{p_{i0}q_{i0}}{\sum_i p_{i0}q_{i0}} / \frac{p_{ih}q_{ih}}{\sum_i p_{ih}q_{ih}} \\ &= \left[\frac{\sum_i p_{ih}q_{ih}}{\sum_i p_{i0}q_{i0}} \right] \frac{p_{i0}q_{i0}}{p_{ih}q_{ih}} \\ &= V \frac{q_{i0}}{q_{ih}}, \text{ if } p_{i0} = p_{ih} \text{ \& } V = \frac{\sum_i p_{ih}q_{ih}}{\sum_i p_{i0}q_{i0}} \end{aligned}$$

Now,

$$(2.5) \quad w_i = \frac{r_i}{\sum_i r_i} = \frac{q_{i0}}{q_{ih}} / \sum_i \frac{q_{i0}}{q_{ih}}$$

which does not involve prices.^{1/} It may be noted that this result continues to hold if p_{i0} and p_{ih} are not equal, but the ratio between them is the same for all basic need goods and services. Here, we ignore any indirect dependence which may result from dissimilar reactions of per capita consumption of the two groups of households to changes in the price of one basic need good relative to another.

Another weighting procedure based on consumer expenditure is to take weights as inversely proportional to the income (or expenditure) elasticities of demand for the basic need goods. Treating a commodity with lower income elasticity of demand as more 'basic' than another with higher income elasticity of demand appears to be 'reasonable' on intuitive grounds. It is easy to check, in the same way as above, that these weights also do not depend on prices.

Two alternative sets of weights, w_{i1} and w_{i2} , based on these last two approaches have been constructed and reported below. It will be seen (Table 2.3) that the two sets of weights are not very dissimilar.^{2/} This is not unexpected if the cross-section and time-series behaviour of expenditure on particular items with respect to

1/ The weights thus turn out to be proportional to ratios of quantities of different basic need goods consumed by the two income classes. In view of this one might consider calculating the weights directly from the ratio of such quantities of consumption. However, data on physical quantities of consumption by different expenditure classes are not available in the Indian NSS reports systematically and for all the relevant items. There are also conceptual difficulties in measuring quantities of services like health and education. In any case, for actual calculation of the weights, it will be much simpler to use the relative budget shares rather than the relative quantities of consumption.

2/ As noted in (Section 2.3) the ratio of budget share weights in case of education and medical care have also been used for the set w_{i2} based on elasticities.

total household expenditure can be treated as similar. The relationship between the two sets of weights can be explained in terms of the Engel curve for the commodity 'i' in Figure 2.1, where E_0 gives the per capita total expenditure level for the low-income class and E_h the level for the high-income class. RT is the tangent to the Engel curve at T. The slopes of the lines OT, OH and RT are given respectively by α , β and γ . Now the weights based on ratio of budget shares, w_{i1} , will clearly be proportional to the ratio α/β . On the other hand, remembering that elasticity is given by the ratio of the marginal to the average, the weights w_{i2} based on inverse of elasticities (at expenditure level E_0) will be proportional to α/γ . Clearly, there is a level of E_h relative to E_0 for which the two weights are exactly equal; and they will not be very unequal if the level of E_h is not very different from that level. Also, in general, the less the curvature of the Engel curve the less unequal are the weights.

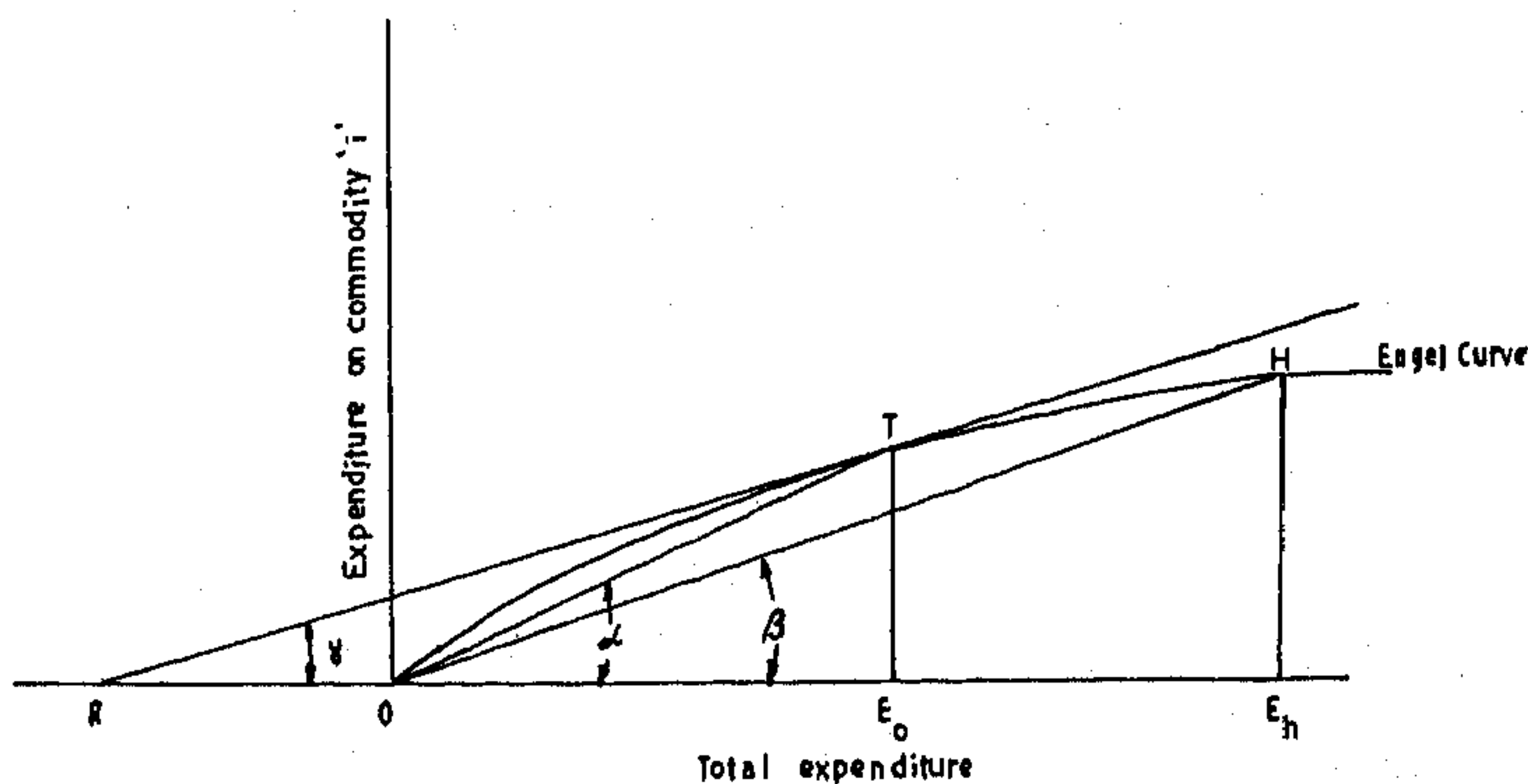


FIGURE 2.1

The weights w_j in the BNG index are constant; while the per capita production q_{jt} changes over time. A question arises as to how we treat the case of a commodity 'j' whose per capita production has exceeded the physical norm $\bar{q}_j$ (however defined). Since the BNG index is intended as an indicator of progress in meeting basic needs, we take the position that in such a case, the index of per capita output q_j should be frozen at the level of the norm $\bar{q}_j$, while keeping the weight unchanged at w_j . This will make the index reflect the success of the community in achieving the norm in respect of j with appropriate weight of the j^{th} item, while not taking into account further growth in the production of this item, because such production can no longer be treated as meeting needs of the same kind of urgency as the other items in the basic need goods basket.

Before concluding this section, we discuss the question of the choice of the low and high income classes. Suppose we choose for the low income class a group of households whose average standard of living falls considerably short of meeting basic needs. In this case, some basic need goods may get negligible budget share or elasticity weights. Thus, it will be appropriate to take in the numerator an income group such that a representative household of this group is just able to satisfy its basic needs, i.e., enjoys a standard of living at or about the poverty line. The group we choose for representing the low income class is the class of households whose per capita monthly expenditure lies between the median and the third quartile of the distribution of rural households in India by monthly per capita expenditure - a class which we may describe as the 'third quartile group' for convenience.

So far as the choice of the high income class for calculating the weights w_{ij} is concerned, what is required is that it be a high enough income group to bring out the differences in expenditure pattern, and hence the relative importance of different basic need goods, sharply. On the other hand there should be comparability in economic, social and cultural environment and in the quality levels of products consumed. For this reason, it is not desirable to take a 'too' high income group also. In this exercise, we have chosen the richest five per cent in the distribution of consumer households by monthly per capita expenditure to represent the 'high income' class.

2.3 CHOICE OF ITEMS AND CALCULATION OF WEIGHTS

Turning now to the details of the actual construction of the index, we first take up the question of the choice of the items in the basic needs basket. Authors like Khan (1977) and Streeten and Burki (1978) are of the view that there are no objective criteria to decide which items should be included in a basic needs basket. Yet in a situation of extreme and widespread poverty and deprivation as in India, there is usually a consensus in defining basic needs in terms of food, water, clothing, shelter, education and health. These items obviously do not exhaust the possibilities, but are common to most discussions on basic needs. We may choose these as constituting the class of basic need goods for the present purpose. Since data on production and household consumption are available for a number of subgroups of food items, it is possible to take separate account of these subgroups in the construction of the BNG index.

In this exercise, the following items have been counted as basic needs: (i) cereals, (ii) pulses and products, (iii) milk and products, (iv) edible oil, (v) sugar and gur, (vi) meat, fish and egg, (vii) clothing, (viii) primary education, and (ix) medical facilities. Due to non-availability of output and expenditure data, we had to leave out housing and safe drinking water from the scope of the BNG index. Thus, apart from our own judgement about the general consensus, considerations of pragmatism as well as available data base have determined the coverage of the BNG index construction.

For calculating weights based on ratios of budget shares, the consumption expenditure data have been taken from the NSS reports. The item-wise per capita expenditure (PCE) of the third quartile group has been obtained as a population-weighted average of per capita expenditure of the expenditure classes coming under that group. The PCE figures for top five per cent of the population have also been obtained likewise.

A set of weights w_i can be constructed in this way from the expenditure data for a single NSS round. To get weights which are free from accidental year to year fluctuations, it was considered desirable to take the average of ratios over a number of years, rather than those of a single year. In our calculations we used consumer expenditure data from 5 rounds of NSS: 20th, 22nd, 24th, 25th and 28th, which cover the period from 1965-66 to 1973-74.

Private expenditure data on education and health are not in general published by the NSSO separately. We could get the PCE figures on education and medicine only for 3 earlier rounds, 7th, 12th and 16th

from tables prepared for Prof. P.C. Mahalanobis in connection with his work for the committee on Income Distribution and Levels of living^{1/}. We used the budget share of private expenditure on these two items obtained from the above rounds only.

For calculating weights based on expenditure elasticities, we have taken the elasticity figures from Radhakrishna, Murthy and Shah (R-M-S) (1979). We have used the elasticities estimated in the R-M-S study at the mean level of the 'middle income group', applying the Linear Expenditure System to NSS consumer expenditure data upto 20th round. The middle income group in the R-M-S study consists of expenditure classes 5th to 8th in the NSS classification scheme. However, the elasticity figures are not available for education and medical care. For these two items, we take the weights to be the same as those obtained from the ratio of budget shares approach. Table 2.3 shows the two sets of weights of the BNG items based on the two approaches.

Table 2.3
Weights of BNG Items

Item	Weight	
	W_1	W_2
1	2	3
1. Cereals	.2333 X	.3310
2. Pulses	.1633 X	
3. Milk	.0788	.0811
4. Edible oils	.1352	.1671
5. Sugar & gur	.1026	.1273
6. Meat, fish & egg	.1352	.1114
7. Clothing	.0491	.0796
8. Medical care	.0609	.0609
9. Education	.0416	.0416

Notes: W_1 based on ratio of budget shares.

W_2 based on income elasticity of demand.

^{1/} These data are available in the National Income Research Unit, ISI, Calcutta.

2.4 THE BNG INDEX AND COMPARISON WITH GDP

Time series data on per capita physical output of various basic need goods^{1/} have been obtained for the years 1950-51 to 1984-85. These figures have been converted into index numbers with 1950-51 as base year. These indices for a particular year when aggregated with weights obtained above give the BNG index for that year. Before discussing the behaviour of the BNG index, a few observations may be made about the per capita output of different BNG items given in Table 2.4. The performance of cereals, the most important item in the BNG basket, has not been unsatisfactory except for a few bad years like 1965-66, 1966-67 and 1979-80. The number of registered medical practitioners has grown faster than any other item. Since we are using this as a proxy variable for medical service, it is possible that in the construction of the index, the growth in the provision of medical service is being overestimated. The performance of pulses has been very poor; its per capita production since the mid-sixties has continuously been lower than the base year (1950-51) level. Milk and edible oils also fall in the 'poor' category.

1/ For some items the output figures in physical unit are not available directly. For such items, we made use of some proxy variables to get output indices. These items are:

<u>Item</u>	<u>Proxy Variable</u>
Primary Education	Number of Primary School Teachers
Medical Care	Number of Registered Medical Practitioners
Edible oils	Oilseeds
Sugar and gur	Sugarcane
Meat-fish-egg	Fish catching and landing

Per Capita Production Indices

Year	Cereals	Pulses	Milk	Edible oils	Sugar & gur	Clothing	Medical 'Prac- 'titioners	Primary 'School 'Teachers	Fish
1950-51	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1951-52	101.1	98.5	100.6	95.9	106.3	111.4	100.5	103.1	98.5
1952-53	113.8	105.4	101.5	88.6	86.3	117.1	102.8	105.6	105.2
1953-54	132.2	119.6	101.8	98.6	73.7	120.2	105.1	109.8	104.5
1954-55	125.2	121.1	102.6	115.4	95.8	122.1	105.5	116.9	103.9
1955-56	120.2	120.0	103.4	101.6	96.9	126.0	113.6	117.5	123.1
1956-57	123.1	122.9	101.9	110.5	108.4	126.1	109.2	118.4	147.0
1957-58	113.3	99.8	100.9	108.1	109.5	119.7	111.1	118.3	124.4
1958-59	129.6	134.3	99.2	121.6	110.4	120.6	119.9	111.1	94.1
1959-60	128.9	118.2	98.3	107.1	114.9	120.0	103.5	114.6	130.1
1960-61	135.2	124.9	97.0	112.0	159.5	125.5	107.1	114.5	105.8
1961-62	135.3	113.0	93.9	114.2	147.3	121.5	109.9	120.0	104.9
1962-63	127.9	108.4	90.9	113.3	127.4	124.7	112.9	123.0	110.1
1963-64	128.7	92.7	88.0	107.0	141.3	131.3	116.3	127.4	136.0
1964-65	137.4	111.8	85.3	124.2	158.8	127.9	119.7	128.9	134.3
1965-66	108.9	87.5	82.5	91.8	160.9	120.3	123.5	165.8	134.8
1966-67	112.7	72.0	82.1	90.4	118.0	117.4	129.8	168.8	135.2
1967-68	138.8	102.1	81.6	114.2	118.8	125.1	135.3	169.4	144.1
1968-69	136.6	85.8	81.3	92.0	151.5	118.3	140.9	167.5	148.1
1969-70	140.5	94.3	80.7	101.8	160.6	118.3	151.9	168.2	157.7
1970-71	151.1	93.2	82.0	119.1	147.0	109.7	159.4	169.5	163.6
1971-72	143.7	85.5	83.8	109.9	129.0	116.0	167.7	133.1	141.5
1972-73	130.1	74.6	85.1	84.2	138.6	108.8	176.4	136.4	165.1
1973-74	138.1	73.6	86.4	106.3	152.8	112.3	185.1	138.0	185.9
1974-75	128.2	72.1	87.7	100.1	153.1	107.0	193.5	139.5	182.6

(Contd.)

Table 2.4.... (Contd.)

Year	Cereals	Pulses	Milk	Edible oils	Sugar	Clothing	Medical 'Prac- 'titioners	Primary 'School 'Teachers	Fish
1975-76	150.6	91.7	89.1	113.7	145.8	110.2	201.3	138.0	171.2
1976-77	136.3	78.2	90.5	88.0	155.3	106.8	209.2	136.4	178.2
1977-78	152.8	80.6	92.1	98.8	175.6	106.9	215.7	134.3	173.9
1978-79	156.1	80.1	92.5	100.3	147.0	118.2	221.3	134.4	172.3
1979-80	128.9	55.1	93.8	84.3	122.1	112.1	229.6	134.6	175.8
1980-81	148.3	66.8	96.0	85.9	142.9	115.3	229.8	134.7	175.1
1981-82	148.5	70.8	102.0	110.2	169.0	112.7	227.2	134.9	174.5
1982-83	140.5	71.4	104.2	86.0	168.2	106.6	232.7	135.3	174.1
1983-84	163.1	76.0	105.7	106.7	151.3	115.7	237.2	135.6	173.6
1984-85	153.5	70.4	112.2	105.1	147.8	115.8	240.0	136.1	173.3

The two BNG index numbers, labelled BNG_1 and BNG_2 , corresponding to the two sets of weights, are presented in Table 2.5, which also contains the index number of per capita GDP at constant (1970-71) prices. Table 2.6 gives a comparative picture of the trend growth rates of the two BNG series and per capita real GDP for different periods. Figure 2.2 depicts the movements of the BNG and GDP series, while Figure 2.3 shows the annual growth rates. The following points emerge from the tables and the figures.

- (1) Over the entire period 1950-51 to 1984-85, BNG index has grown at a slower rate than per capita GDP (Table 2.6). The exponential trend growth rate of GDP per capita (1.43%) has been more than double that of either BNG_1 (0.69%) or BNG_2 (0.60%).
- (2) During the period 1950-51 to 1964-65, the BNG index in both the versions registered a moderate trend growth rate of 1.4% per annum. However, there was near stagnation of BNG index since mid-sixties. The BNG growth rate is less than half a per cent during 1967-84, when per capita GDP continued to grow at about 1.5%. The BNG growth did not go up even when GDP showed acceleration tendency after 1974-75.
- (3) During the first decade of the planning era, the BNG indices remained above the per capita GDP index, but continuously stayed below thereafter (Figure 2.2). The lag in the BNG series behind the GDP series is particularly pronounced during the seventies and early eighties. The per capita GDP in 1984-85 was about 70% higher than its 1950-51 level, whereas the BNG indices were only about 35% higher over comparable period.

Table 2.5

Indices of BNG and Per Capita GDP

Year	BNG ₁	BNG ₂	GDP (Per capita)
1950-51	100.00	100.00	100.00
1951-52	100.64	100.97	100.30
1952-53	103.22	101.99	101.90
1953-54	110.29	107.97	106.35
1954-55	113.82	113.13	107.31
1955-56	114.09	112.99	108.71
1956-57	120.50	119.22	112.38
1957-58	110.90	110.52	108.27
1958-59	118.31	118.09	114.92
1959-60	117.96	116.53	114.83
1960-61	122.84	123.00	120.45
1961-62	119.79	119.58	121.91
1962-63	116.10	115.82	121.76
1963-64	118.29	117.65	125.22
1964-65	127.21	126.93	132.24
1965-66	113.66	114.02	122.51
1966-67	107.80	106.66	121.21
1967-68	124.02	121.98	128.94
1968-69	121.64	119.51	129.33
1969-70	128.17	126.09	134.68
1970-71	132.38	129.40	139.01
1971-72	122.76	120.25	137.88
1972-73	118.90	115.93	133.38
1973-74	128.76	125.91	136.68
1974-75	125.37	122.92	134.92
1975-76	134.00	130.70	144.65
1976-77	127.27	124.06	142.51
1977-78	134.92	131.56	151.51
1978-79	133.61	129.73	156.52
1979-80	119.25	115.77	145.50
1980-81	128.29	124.20	152.63
1981-82	135.06	132.34	157.73
1982-83	130.09	126.96	159.01
1983-84	137.98	133.86	168.36
1984-85	134.92	131.32	171.31

Notes: 1. GDP series at factor cost at 1970-71 prices; indices obtained from CSO estimates.

2. BNG series constructed by us. BNG₁ uses weights based on ratio of budget shares and BNG₂ uses weights based on income elasticities of demand.

Table 2.6

Growth Rates of BNG and Per Capita GDP

(Per cent per annum)

Period	BNG ₁	BNG ₂	GDP (real per capita)
1950-51 to 1984-85	0.69	0.60	1.43
1950-51 to 1964-65	1.38	1.41	1.86
1967-68 to 1984-85	0.47	0.40	1.53
1974-75 to 1984-85	0.47	0.42	1.99

Notes: Growth rates for different periods are estimated
by fitting semilog time trends.

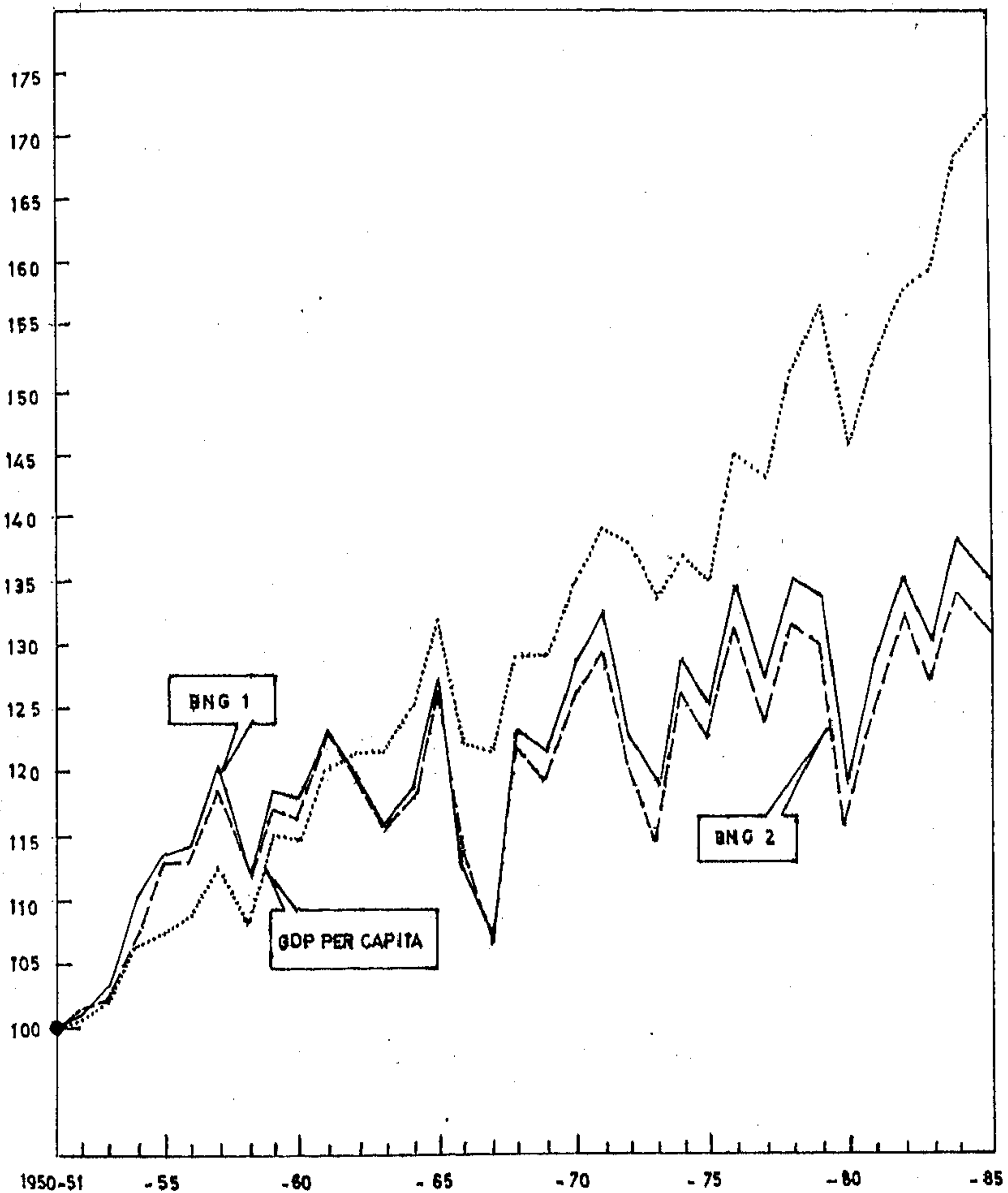


Figure 2.2: The BNG and GDP Index Numbers.

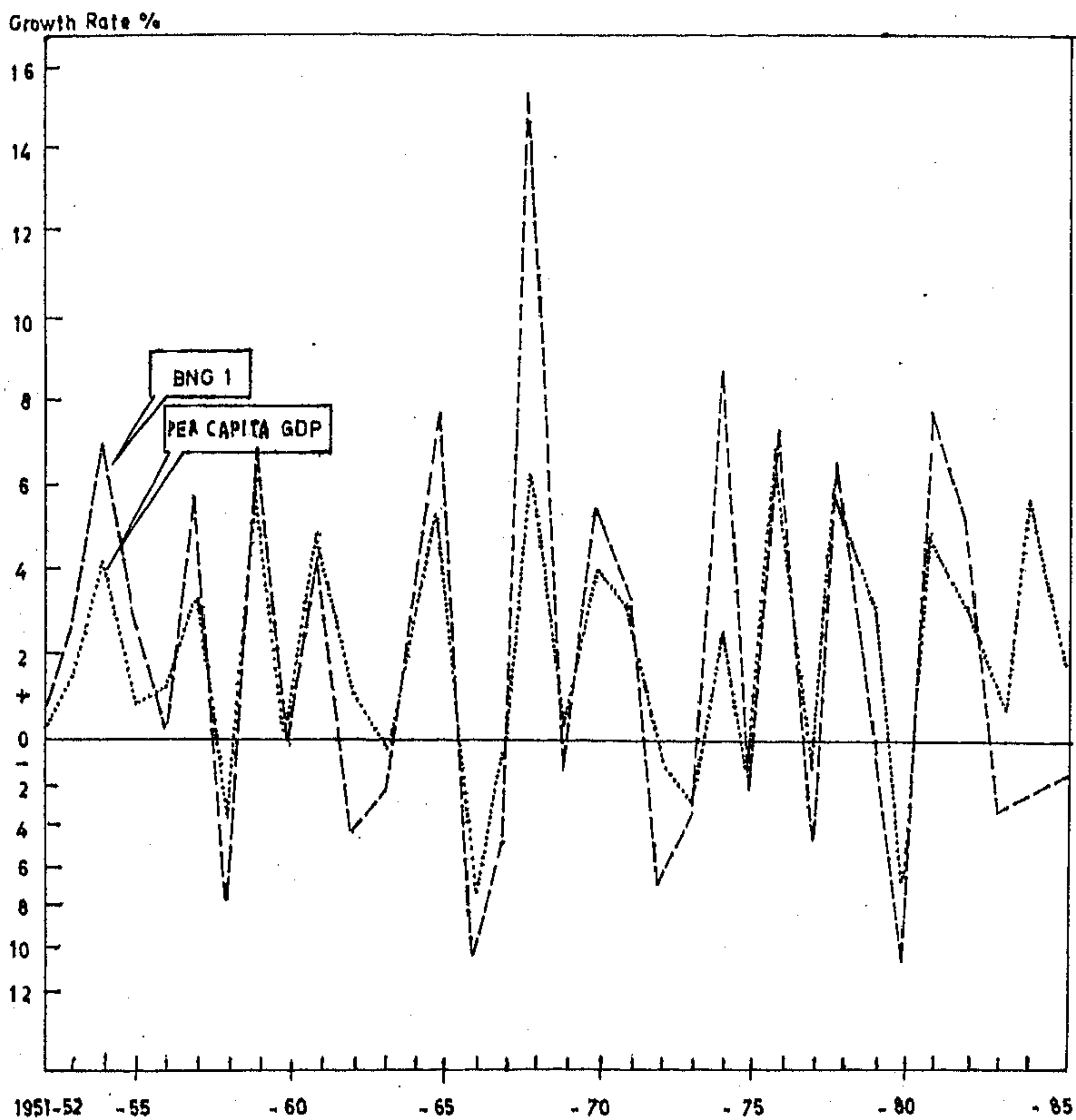


Figure 2.3: Annual Growth Rates (%) in BNG₁ and GDP Series.

- (4) The year-to-year fluctuations in BNG (Figure 2.3) have in general been sharper than corresponding fluctuations in per capita GDP^{1/}. When growth in GDP has slowed down, the growth in BNG has slowed down by a larger extent, and when growth of GDP has been accelerated, the growth of BNG has been accelerated further. (A few exceptions occur like the year 1983-84). The bigger fluctuation in BNG compared to GDP is intuitively a plausible one. Agricultural output fluctuation may be seen as the major causal variable for both BNG and GDP series, and the fact that agriculture (food) has got a more dominant weight in BNG than GDP explains the phenomenon.

Deceleration Test

The results above point towards a hypothesis that the BNG index has decelerated since mid-sixties. We now investigate this proposition more carefully through a statistical test. In order to test if growth rates in two periods differ significantly from one another, we estimate the following type of function:

$$(2.6) \quad \text{Log } Y_t = a + b D + c T + d D.T.$$

Where,

Y_t = relevant variable (BNG₁ or BNG₂) for year t

T = time variable (with 1950-51 as 1, 1951-52 as 2 and so on)

D = 0 for first period (1950-51 to 1964-65), and
= 1 for second period (1965-66 to 1984-85).

The dummy variable D has been used in both additive and multiplicative form, the former to permit differential intercepts and

^{1/} Figure 2.3 shows the annual percentage variations in BNG₁ only. The variations in BNG₂ series is very close to those in BNG₁, often coinciding with each other. Hence, the annual growth in BNG₂ is not shown in Figure 2.3 to avoid clumsiness.

the latter to permit differential slopes. Parameters a and c respectively refer to intercept and slope of the first period, while the sums $(a+b)$ and $(c+d)$ respectively refer to intercept and slope of the second period. In other words, the implied regression for the second period is:

$$\text{Log } y = (a + b) + (c + d) T.$$

The estimates of c and $(c + d)$ give the growth rates in first period and second period respectively. An advantage of the above form is that a direct test is available here for the significance of difference in growth rates between the two periods. A test for whether coefficient d is significantly different from zero will show whether the trend growth rate in the second period is significantly different from the trend growth in the first period. A similar test for coefficient b will show if there is any significant difference in the intercepts for the two periods.

Even when we do not have periodisation, we can still test for acceleration or deceleration in BNG over the entire 35 years. A semi-log quadratic function of the type

$$(2.7) \quad \text{Log } Y = a + b T + c T^2$$

fitted to the whole period will suffice in this case. A test for decelerating (accelerating) growth of Y amounts to testing if coefficient of T^2 is significantly negative (positive) against the null hypothesis that it is zero.

Table 2.7 presents results relating to estimation of regression equations for the above two types of functions. The results establish the deceleration hypothesis since mid-sixties. The coefficients of D.T.

Dependent Variable	Const	dependent Variable			
		T	D.T.	T ²	R ²
1	2	4	5	6	7

A. Eqn. : $\log Y = a + b D + cT + d DT$

A.1 Period: 1950-51 to 1984-85

Log BNG ₁	4.6262	0.0267 (0.53)	0.0137 (5.25)	- 0.0063 (2.03)	.76
Log BNG ₂	4.6181	0.0391 (0.80)	0.0141 (5.52)	- 0.0077 (2.53)	.73

A.2 Period: 1950-51 to 1984-85
Excluding 1965-66 & 1966-67

Log BNG ₁	4.6262	0.1074 (2.06)	0.0138 (5.93)	- 0.0091 (3.12)	.81
Log BNG ₂	4.6181	0.1089 (2.11)	0.0141 (6.10)	- 0.0101 (3.48)	.78

B. Eqn. : $\log Y = a + b T + cT^2$

Period: 1950-51 to 1984-85

Log BNG ₁	4.6401	0.0121 (3.80)	- 0.00015 (1.69)	.72
Log BNG ₂	4.6364	0.0120 (3.74)	- 0.00016 (1.91)	.67

Note: Figures in parenthesis are t - values.

are negative and significant for either BNG series. If the two years 1965-66 and 1966-67 are excluded from the second period, the deceleration is stronger than when they are included. Taking the period as a whole without any sub-period, deceleration is again found to be significant.

Lastly, it may also be of interest to examine the relationship between the incidence of absolute poverty and the BNG index. The estimates of head-count ratio (HCR) at all-India level are available for 14 years as given in Table 2.2. The regression of these ratios on BNG index for those years yields the following equations:

$$\text{HCR} = 105.70 - 0.4844 \text{ BNG}_1, \quad R^2 = 0.34 \\ (2.46)$$

$$\text{HCR} = 96.66 - 0.4047 \text{ BNG}_2, \quad R^2 = 0.29 \\ (2.23)$$

The coefficient of either BNG is negative and significant indicating a rise in BNG index has distinct poverty reducing effect.^{1/} The low explanatory power of the BNG index could be due to two main reasons. First, the distribution factor neglected in the BNG index would affect variations in HCR. Second, the dependent variable HCR is defined in terms of per capita total expenditure and as such income generated in the non-BNG sector would also influence HCR.

^{1/} Ahluwalia (1978, 1986) finds a negative relationship between movement of poverty and agricultural output. As our BNG index is dominated by agricultural items, it corroborates Ahluwalia's findings.

2.5 CONCLUSION

The Indian economy has witnessed sustained national income growth of a moderate kind after the initiation of Five Year Plans. National income measures like GDP or NNP are, however, not very satisfactory yardsticks of economic well-being in developing countries where provision of essential commodities must be given a high priority. In this chapter we have constructed an index of basic need goods as a possible supplementary yardstick for this purpose. A small set of essential consumer goods which qualify as basic needs have been taken into account in constructing this index. For the purpose of aggregation of elements of the BNG set, two alternative weighting systems have been derived on the basis of consumer preferences as revealed in actual consumption expenditure.

By its very nature, any index of the BNG variety must contain some elements of arbitrariness and this applies to the index proposed here. As is evident from the earlier discussion, the choice of items, based mostly on common acceptability, are arbitrary to some extent. The BNG index constructed here leaves out a few important BNG items like housing and clean drinking water due to non-availability of production or consumption data. These two are generally accepted as basic needs in the literature and there is a need to build up the data base.

The BNG index proposed here is a simple one and relevant for evaluation of progress for meeting basic needs. It will cease to be relevant once the basic need objective is fulfilled. Till then, some such measure as the BNG index could play an useful role. The particular

BNG index constructed here, for example, reveals that there has been near stagnation in per capita production of BNG goods since mid-sixties. The production structure has shifted markedly towards the non-BNG components of GDP specially from mid-sixties onwards. This happened when the objective of eradication of poverty or provision of basic needs was stated more forcefully in the plan documents.

Chapter 3

NUTRITIONAL ISSUES

3.1 INTRODUCTION

While the last chapter dealt with past performance in the field of basic needs, this and the following chapters relate to planning for basic needs in future. This chapter examines the various nutritional issues that provide a normative basis for setting food consumption targets in a plan. There are two broad aspects of nutritional need: (a) quantity aspect; and (b) quality aspect. The quantity aspect generally refers to adequacy of calorie or energy in food intake, whereas the quality aspect normally refers to adequacy of non-calorie nutrients like proteins, vitamins and minerals. Correspondingly, people whose diet fails to meet the minimum required level of calorie are called 'undernourished', while people whose diet lacks the necessary quality are described as 'malnourished'. An undernourished person is also normally malnourished, though the reverse may not be true.

An important and lively debate is going on at present, particularly in India, on the choice of a critical limit of calorie relevant for measurement of the incidence of undernutrition, i.e. the proportion of undernourished in the population. Nutrition experts of several international and national organisations like World Health Organisation (WHO), Food and Agriculture Organisation (FAO) and Indian Council of Medical Research (ICMR) have for long been recommending calorie requirements based on average intake observed among healthy active population of specific age-sex-activity groups. In estimating incidence of undernutrition, a common practice has been to choose the recommended average calorie for a 'standard person' as a benchmark or

critical limit and treat the people having calorie intake less than the benchmark value as undernourished^{1/}

A major criticism against the use of the average calorie as the critical limit has come from P.V. Sukhatme and his associates (Sukhatme, 1978, 1982, Sukhatme and Margen, 1978). Sukhatme argues that the long-term calorie requirement of an individual is not fixed, but varies over a large range and that the human body possesses an autoregulatory mechanism of adjustment or adaptation over this range. He finds this intra-individual variation dominates the inter-individual variation that arises due to different physiological characteristics among otherwise similar persons. Due to the autoregulatory nature of intra-individual variation, Sukhatme claims that the 'right' critical limit for measuring undernutrition should be the lower limit of the range of energy variation instead of the mean of the range that is commonly used. Such a change in the choice of the critical limit brings down the incidence of undernutrition substantially from about 40% to about 20% of Indian population. The validity of Sukhatme's criticism assumes importance in practice in so far as the size of undernourishment is a main determinant of the dimension of a plan. Accordingly, a large part of this chapter is devoted to an assessment of Sukhatme's logic and procedure. We then discuss issues related to quality aspect of nutrition requirement and selection of food consumption targets on both quantity and quality grounds.

In section 3.2 we examine Sukhatme's hypothesis accepting his model of calorie requirement and his propositions about the roles played by different components of variability. The conclusion drawn is that, even after accepting the model and the propositions, there are valid statistical reasons for

^{1/} The income-equivalent of benchmark calorie level is often considered as poverty line and people below this income as poor (e.g. Dandekar and Rath, 1971). The poverty line as such is not considered in this chapter.

considering calorie cut-off or benchmark lines higher than that advocated by Sukhatme. Section 3.3 raises some questions about Sukhatme's proposition on adaptation itself. Finally, section 3.4 discusses the need for considering the quality aspects of nutrition in a plan and setting consumption targets in terms a balanced diet basket that takes into account both quantity and quality aspects of nutrition.

3.2 DISCUSSION OF SUKHATME'S MODEL*

It is customary among nutritionists to consider calorie requirement for a reference or standard person specified with respect to age, sex, body-weight, activity and environmental temperature. The Indian reference man is an adult between 20-39 years of age and weighs 55 kgs. On each working day he is engaged in an occupation that usually involves moderate activity. While not at work, he spends 8 hours in bed, 4-6 hours sitting and moving around and 2 hours in walking and active recreation or in household duties. The energy requirement of the Indian reference man has been placed at 2800 calories by ICMR. Persons belonging to other age-sex-activity groups are standardised in relation to the reference man. An average Indian family consisting of 5 persons is found to be equivalent to 4 consumer units or reference men. The model of calorie requirement discussed below assumes all persons are expressed in terms of standard units.

Sukhatme's hypothesis

Now, calorie requirement varies from one individual to another even when both belong to the same age-sex-activity group as that of the reference man. Besides such 'inter-individual' differences, there are

*_ This section is largely based on Chakrabarti and Panda (1981).

'intra-individual' differences in requirement; i.e. the requirement of the same individual doing the same type of work and maintaining body weight is not constant from one day to another, but varies around the long-run mean value for the individual. Thus, the calorie requirement of the i -th individual on day t can be written as:

$$(3.1) y_{it} = m + b_i + w_{it}$$

where m is the calorie requirement of the reference individual and b_i and w_{it} are respectively the components due to inter-individual and intra-individual variability (Sukhatme, 1978; Sukhatme and Margen, 1978). Sukhatme assumes b_i and w_{it} are distributed normally around mean 0 with variances s_b^2 and s_w^2 respectively.

Let $s^2 = s_b^2 + s_w^2$. Then according to Sukhatme, the critical calorie intake of an individual below which he suffers from undernutrition is $m - 2s$. If the intake lies within $m \pm 2s$, the process is 'in statistical control'. He says: "When the observed intake for any day or period is less than the average requirement, worked out from FAO/WHO scale, it cannot be taken to imply that a man is undernourished as Dandekar and Rath do, unless his intake is so low as to be below the lower limit of the confidence interval for the chosen level of significance (Sukhatme, 1978, p.1383).

Variability Characteristics

Let us first consider 'intra-individual' variability, given by the component w_{it} in (3.1) above. Let $y_i = m + b_i$. Now, w_{it} measures the extent to which the individual's energy requirement on any day t deviates from his long-term average requirement y_i . According to Sukhatme, this deviation is determined mainly by the actual energy intake of the individual on any day t , and shows how his requirement 'adapts'

to his intake. He says: "...calorie requirements adapt themselves to intake within a range of $m-2s$ to $m+2s$. The mechanism for this adaptation is provided by the regulatory mechanism of the appestat and is reflected in large values of intra-individual variation..." (Sukhatme 1977, p.671; emphasis added; notations as ours). Such adaptation or adjustment can take place within the range of effective variability of w_{it} , viz., $\pm 2s_w$ around the mean y_i . For individual i , therefore, there is no question of either excess or deficiency so long as energy intake is contained within these limits $y_i \pm 2s_w$ which he calls 'homeostatic' range.^{1/}

Accepting the above view about adjustability of energy requirement to intake, one might ask if it is possible to give individual i the calorie level $m+b_i - 2s_w = y_i - 2s_w$ every day for a long period of days without forcing this mechanism of adjustment to break down? The answer to this question appears to be 'no', according to Sukhatme. For such periodic average (weekly, monthly, etc.) levels of intake, the effective tolerance limits of the adjustment mechanism (averaged over appropriate number of days) will be narrower, given by $y_i \pm 2s_{wp}$, where s_{wp}^2 is the variance of average w_{it} over p days and is smaller than s_w^2 (which refers to $p = 1$).

According to Sukhatme, the w_{it} series follows an autoregressive process of the first order. The variance of w_{it} averaged over p days will fall from s_w^2 by a factor h/p where

$$(3.2) \quad h = \frac{1+r}{1-r} - \frac{2r(1-r^p)}{p(1-r)^2}$$

(See, Sukhatme, 1982). Here r is autocorrelation coefficient. The factor h/p depends on particular values of p and r .

^{1/} The precise limit used by Sukhatme has varied over the years. Recently he has consistently been using 2 s.d. limit, although in some of his earlier writings he has used 3 s.d. limit (Sukhatme, 1965).

Turning next to the component of interindividual variation b_i , one explanation of this component is the difference of the activity and weight of individual i from those assumed for the 'reference' individual. But there are other factors - 'some individuals are apparently much more efficient machines than others'.

Implications

If the above characterisation of the two components of variation of y_{it} around m is correct, it is necessary to maintain a distinction between them for the present purpose of defining a minimum energy requirement. A value of w_{it} (for particular i and t) within the range $\pm 2s_w$ means that the calorie requirement of individual i for day t has varied to that extent from the mean requirement y_i mainly in response to variation in his intake. Within this range, therefore, intake and requirement are not two independent variables - one component of requirement (w_{it}) being determined by intake. As such, within these limits, the individual's minimum energy needs are met automatically - by definition of requirement, so to say. There is, therefore, no point in comparing the individual's intake and requirement, within these limits of intake, to check if there is undernutrition.

On the other hand, a particular value of b_i indicates the difference of individual i 's average requirement from the overall average requirement, m . It is, therefore, quite appropriate to compare the actual average intake of individual i , say x_i , to his average requirement $y_i (= m + b_i)$ to determine whether his energy requirement is met or not. In view of this difference in the status of the two components of variability, while it may be right to claim that there is no possibility of undernutrition if the daily intake x_{it} lies within the range $y_i \pm 2s_w$,

it is not right to claim also that there is no possibility of under-nutrition if the daily intake x_{it} lies within the range $m \pm 2s$, where $s^2 = s_b^2 + s_w^2$. But this is exactly what Sukhatme does in most of his works.

Let us forget for the present intra-individual variation and consider only the component of interindividual variation. Sukhatme states that the (long period) average intake and average requirement of an individual i are, by and large, independent variables. If, then, the average intake x_i of a randomly selected individual is found to be equal to $m - 2s_b$, there is a valid sense in which one can say that the probability that his energy requirement is not met is about 97.5 per cent, while the probability that his requirement is met is only about 2.5 per cent. Similar probability statements apply for any other value of average energy intake x_i . In particular, if the average intake of an individual is equal to m , the probability that his requirement is met is equal to the probability that it is not met viz. 0.5.

We may note that calorie intake data are usually available for households rather than individuals. The value of s_b^2 should then be adjusted for any comparison of intake with requirement. When household is the unit of collection of data, the case is similar to that where observations are obtained for clusters of units. Let an average household consist of n consumer units. Assuming, with Sukhatme, independence of their calorie requirement, the variance of per consumer unit requirement of a household is $s_b^2 / n = s_{bh}^2$, say.

Calorie Cut-off Line

With the above discussion on characteristics of inter- and intra-individual variations in requirement, we may now proceed to identify

persons suffering from undernourishment. One point we may note is that it is not necessary to follow the common practice of specifying a calorie cut-off line x^* and estimating proportion of persons falling below x^* , if the purpose is measurement of 'incidence of undernutrition'. For this purpose, one may consider the joint distribution $f(x, y)$ and calculate the probability $P(x < (y - 2s_{wp}))$ given information on mean and variance of x and y distribution.^{1/} This procedure, however, does not enable us to identify the undernourished persons or households who may form the target group in a plan. In order to identify such target groups, we have to select a calorie cut-off line so that household below this line could be located by means of information on their intake (or, a close proxy like income). The problem in fixing the cut-off line is that the component b_i is unobservable, but has a normal distribution around zero with variance s_b^2 . Under this circumstance, all that one can conclude about a person having long-term average intake x_i (assuming a knowledge of distribution of y_i) is a certain probability that he or she is undernourished (and a corresponding probability that the person is not). If, therefore, a critical value like x^* has to be specified, one has to be satisfied with a probabilistic interpretation of undernourishment, agreeing to characterise a unit as undernourished if there is a probability z^* that it suffers from undernourishment.

There is little a priori basis for choice of a value of z^* ; it will depend on one's attitude towards two opposite kinds of error. If one is particularly anxious to avoid the error of inclusion i.e. of classifying a household as undernourished while it is not so, then one would go for a sufficiently high value of z^* . A value of $z^* = 0.975$, for

^{1/} See, Chakrabarti and Panda (1981) for experiments on different intake distributions like normal and beta.

example, would lead to $x^* = m - 2s_{bh}$. If, on the other hand, one is particularly anxious to avoid the error of exclusion i.e. of not classifying a household as undernourished when it is actually so, one would go for low enough value of z^* . A value of $z^* = 0.025$ would lead to $x^* = m + 2s_{bh}$. If one prefers to strike the mean between these extreme options, one would choose $z^* = 0.5$, which leads to $x^* = m$.

Thus, if one ignores intra-individual variation in requirement as being insignificant because of the length of the period of averaging (say, for annual data), the possible cut-off lines are:

A 1: $x^* = m - 2s_{bh}$. This is based on a high value (0.975) of the probability that a unit classified as undernourished is actually so, - an approach favoured by Sukhatme.

A 2: $x^* = m$. This is based on the probability of 0.5. This is the one used by Dandekar and Rath and many others.

A 3: $x^* = m + 2s_{bh}$. This is based on a low value of possibility of undernourishment and takes care of the need of all but a small fraction of the population.

If intra-individual variability is to be taken into account, these cut-off lines will be reduced to:

$$B\ 1: x^* = m - 2s_{bh} - 2s_{wp}$$

$$B\ 2: x^* = m - 2s_{wp}$$

$$B\ 3: x^* = m + 2s_{bh} - 2s_{wp}$$

It will be noted that one of these lines, viz., B 1, is similar to the critical value recommended by Sukhatme.^{1/} But the argument leading

^{1/} The line B 1 is not exactly the same as that suggested by Sukhatme, because s is different from $s_{bh} + s_{wp}$.

to this value is different from that usually employed by Sukhatme. Also as we have attempted to explain above, given the variability of individual energy requirement, this or any other line put forward as the critical value is only one of several alternative choices each with a plausibility of its own.

To get numerical values for these cut-off points, we may use $m = 2800$ calories which is the level recommended by ICMR for Indian reference man. The co-efficient of variation of y has of late been placed by Sukhatme (1982) at 20%, which yields $s = 560$. This corresponds to observations on individuals on daily basis. Sukhatme always says that intra individual variation is 'fundamental' or 'dominant' source of total variation, but he rarely spells out the exact relative quantitative dimensions of s_b and s_w .^{1/} Using figures from one experiment^{2/} reported in Table 3 (Sukhatme, 1978), we get s_w^2 is 87% of s^2 . This percentage together with $s = 560$ imply $s_w = 522$ and $s_b = 202$. These figures need to be adjusted to take into account the fact that NSS data refers to consumption per household per month. Since on an average a household consists of 4 consumer units, $s_{bh} = s_b / \sqrt{4} = 101$. Next, w_{it} may be assumed to have autocorrelation coefficient of 0.4 (Sukhatme, 1978, p. 1381). For averaging over time of 30 days for a given individual i , formula (3.2) shows intraindividual variance s_{wp}^2 is reduced to the fraction 0.078 of s_w^2 . Averaging over consumer units of

1/ Anyway, he does not need it because of his use of s rather than s_w or s_b .

2/ Figures given are $s = 440$ and $s_w = 410$. One may now think s_b is negligible. But in fact it is not so, because

$$s_b = \sqrt{440^2 - 410^2} = 160$$

When squares are additive, how misleading it is to report total and one component!

a household reduces the fraction further to 0.019. Thus, the magnitude of variance due to intra-individual variability at proper levels of averaging (s_{wph}^2 say) is only about 2% of s_w^2 . This gives $s_{wph}^2 = 5134$ or $s_{wph} = 72$.

With the help of these parameters, we may now compute the following cut-off lines relevant for NSS data:

$$B\ 1 = 2450, \quad B\ 2 = 2650 \quad \text{and} \quad B\ 3 = 2850$$

To repeat, these three points correspond to three specific probability levels of undernourishment of the household. Any chosen level of probability and corresponding calorie cut-off point will involve value judgement in the form of errors of inclusion and exclusion.

3.3 QUESTIONS ON ADAPTATION

Upto now we have discussed incidence of under-nutrition accepting Sukhatme's adaptation hypothesis. In recent literature this hypothesis itself has been a matter of controversy. So, it will be useful to discuss some of the controversial points before deciding to select one of the several possible calorie cut-off points with associated risks noted above.

Threshold

The cut-off point $m - 2s$ advocated by Sukhatme is a statistical critical limit for a given significance level. Sukhatme (1978) explicitly recognises this as "the lower limit of confidence interval for the chosen level of significance" (p.1383). On the same page, he also says: "clearly, undernutrition must be defined as failure of the process to be in statistical control". Thus, Sukhatme's logic for choice of calorie cut-off line is clearly based on the assumption of

statistical (normal) distribution in variation which enables him to make the probability statements for various ranges of variation. In a recent writing, he places 'physiological meaning' to the cut-off point and interprets it as a physiological threshold (Sukhatme, 1981). The implication he then derives is that the critical limit should be the same whether observations are for single units (e.g. individuals) or clusters of units (e.g. households). In order to do so, there must be clinical evidence to support the view that the physiological threshold is the same for all individuals. In the absence of such evidence, the statement is merely an assertion. Secondly, and more importantly, there is no reason why a physiological threshold would so neatly coincide with the statistical limit discussed earlier.

Autocorrelation

Sukhatme says successive values over time in energy balance of a man are correlated in first order Markov process and this he considers as evidence of his adaptation hypothesis. One's immediate reaction is: how does autocorrelation imply adaptation? Dasgupta and Roy (1986) cite an example: a farmer's energy intake is related to agricultural production cycles, while energy expenditure remains more or less constant. Such a series would show autocorrelation, but it is exogenously induced and cannot be attributed to any regulatory mechanism of the body.

Some studies do not even find existence of autocorrelation in energy balance data. Rand, Scrimshaw and Young (1985) find autocorrelation in only 4 out of 42 subjects after correcting the data for a trend element. Although Sukhatme relies so much on autocorrelation for his

analysis, he gives only indirect evidence by calculating variance of mean intake averaged over a number of successive days and stating that this variance does not decrease as fast as one would expect in a series of random observations. It is surprising that he does not provide direct evidence like correlogram for energy balance, though elsewhere he does it for nitrogen balance (Sukhatme and Margen, 1978). But to what extent the extrapolation of protein balance result to energy balance is valid is an open question, particularly because old protein is recycled in the body to a large extent.

Mechanism

The possible mechanisms of adaptation suggested by Sukhatme, e.g. reduction in basal metabolic rate^{1/} with fall in intake, have been put to detailed scrutiny by Dasgupta and Roy (1986). After going through the relevant literature (including the ones cited by Sukhatme) they conclude: "The existence of adaptation is far from clear. Indeed, where some form of adaptation can be shown to be present (such as in BMR), it finds a countervailing form of 'negative' adaptation, such as reduced work capacity" (p.61).

The evidence on adaptation is, thus, far from conclusive. If it exists, it is possibly not without cost in the form of reduced work capacity or body weight. There may be other costs to sustain low level of energy intake. It may increase susceptibility to infection by impairing body's defence system. There is also possibly an inverse relationship between morbidity and energy intake. These possible risks involved in adaptation should not be lost sight of. Such risks are

^{1/} BMR is energy expenditure of an individual who is at rest.
It is necessary to support different body functions.

obviously not acceptable to many. Hence, the probability of classifying a person as not undernourished, when he is actually so, should be chosen with caution.

3.4 BALANCED DIET

The discussion upto now has been on calorie or the quantity aspect of nutrition. Apart from calorie, the human body needs protein, fat, several kinds of minerals and vitamins. In this section we look into non-calorie dimensions of the nutritional problem and argue that food targets in Indian Plan should be set in terms of balanced diet baskets - balanced from the point of view of all essential nutrients. Since calorie is the single most important nutrient, the minimum calorie need discussed in earlier sections is a major determinant of balanced diet. But other nutrients too have their own vital roles, as nutrition is essentially a multidimensional problem.

An important finding due to Sukhatme and others in recent years is that protein by itself is not a serious problem in Indian diet. The nature of normal dietary pattern in India and many developing countries is such that protein needs are almost always met when calorie needs are also met (Sukhatme, 1974; Gopalan, 1983). The protein problem mainly occurs for diets heavily dependent on tubers and roots as sources of calorie. But the general cereals-pulse based diets consumed in India do provide sufficient protein if man eats enough to derive sufficient calories. The qualification regarding energy sufficiency is important because otherwise protein (like fat) is converted to calorie.

While calorie and protein intakes have high positive correlation, there is no reason to expect such correlation of calorie with other nutrients. In fact, incidence of vitamin B group deficiency is found to be more among calorie sufficiency groups (Gopalan, 1983). Also, as Dasgupta (1983) reports, "there is almost no expenditure class where the mean intake level is more than the average recommended level" for calcium and vitamin A. Nutrient deficiencies generally considered to be serious in India are calcium, vitamin A, iron, iodine and B group vitamins. The food sources for these minerals and vitamins are not generally major sources of calorie. So, calorie intake does not provide much indication about these nutrients.

There is widespread prevalence in India of diseases like anaemia, endemic goitre, blindness, night blindness, toad skin and rickets, which occur due to deficiency of specific vitamins and minerals in the body. These diseases could be prevented by providing the missing nutrients such as iron for anaemia, iodine for goitre, vitamin A for impairment of vision (See, Gopalan et. al. 1978). The problem of malnutrition is thus not a matter of minor concern. Nor can it be removed with adequate calorie intake. Hence, the need to tackle malnutrition together with undernutrition through provision of a balanced diet basket, which meets the quantity as well as quality aspects of nutrition.

Although a balanced diet basket is primarily designed to meet the various nutritional constraints, a few other considerations must be taken into account while constructing such a basket. Costs and tastes are two important factors influencing consumer behaviour. These factors must be considered in addition to nutritional constraints while determining

a balanced diet basket. A standard method for obtaining this basket involves solution of a linear programming problem of the following type:

$$\begin{aligned} &\text{minimise} && \sum_{j=1}^k p_j q_j \\ &\text{subject to} && \sum_{j=1}^k n_{ij} q_j \geq c_i \end{aligned}$$

where q_j = quantity of consumption of the j^{th} food item.

p_j = price per unit of j^{th} item.

n_{ij} = amount of nutrient i available per unit of j^{th} item.

c_i = minimum requirement of i^{th} nutrient.

The solution to the problem would give the least cost balanced diet basket $(q_1, \dots, q_k)$. While solving the problem, some practical considerations like taste, availability, and culinary practices are also considered. These practical factors are normally introduced in the form of maximum or minimum limits on particular food items (e.g. edible oils consumption to lie between a minimum of 15 gms per capita per day and a maximum of 30 gms). Among others, Sukhatme (1965) and ICMR (1981) have worked out balanced diet baskets for India.

Given the discussion in the earlier sections, a natural question now is: what are the appropriate levels of various nutrients (c_i 's) that a balanced diet basket should satisfy? The ICMR (1980) basket meets the nutritional requirements at $m + 2s$ level for all nutrients other than calorie. Under normal distribution assumption, this level more than meets the requirement of about 97% of the population. The ICMR nutrition advisory group considers that intake in excess of need is not injurious to health in case of non-calorie nutrients. Obviously here the error of 'exclusion' (section 3.2) is being minimised.

For calorie the ICMR group does not follow this rule. It says: "...allowances for energy is average requirement and the two standard deviation is not added. This is because energy intake and expenditure of an individual are finely balanced and any surplus energy consumption is stored as fat and a continuous excess intake will lead to obesity which is a well recognised health risk." (ICMR, 1981, p.2). Thus excess calorie on a continuous basis does pose a problem just as the case of calorie deficiency discussed earlier. Note that the choice of the mean strikes a balance between the tolerance limits of the two kinds of conflicting errors, namely, error of omission and error of inclusion explained in section 3.2. Depending on the tolerance limits, one may choose this or any other level, in the calorie requirement range, that a balanced diet should satisfy. As we have argued in this chapter, the corresponding value judgement should, however, be clearly understood. In particular, choice of the lower limit minimises the error of inclusion and maximises the error of exclusion, and in the process the implied value judgement is terribly biased against the undernourished. If the lower limit like B 1 discussed earlier is used as target in a macro plan, almost everybody's requirement will be higher than the target. On the other hand, if plan target is fixed at the upper limit, almost entire population (all but 2.5 per cent) will be overeating. The ICMR choice of the mean of the distribution seems to have a more acceptable basis for setting energy target in a plan.

In the following chapters we discuss some of the problems that arise in ensuring consumption of a balanced diet basket in a plan. The particular levels of the components of the basket are not so much relevant in chapters 4 and 5 as the multidimensional character of

consumption targets and their determinants. The particular levels assume significance in the empirical results in chapter 6.

Chapter 4

ABSORPTION PROBLEM AND INCOME PRICE STRATEGY

4.1 INTRODUCTION

We have stated in Chapter 1 the absorption problem as recognised by Ghai et. al. (1977) and Rudra (1978) when consumption targets are set in terms of a basket of basic need (BN) goods. To restate, let $q_1^*, \dots, q_k^*$ be the per capita consumption norms that constitute the BN basket. If $\sum_i P_i q_i^*$ be the cost of BN basket at prevailing prices, the poverty line (PL) is estimated as the per capita income level corresponding to which expenditure on the k BN goods equals the cost of the BN basket.^{1/} The problem of absorption is that a representative consumer with income equal to PL may not consume the specified quantities $q_1^*, \dots, q_k^*$. In other words, even when a planning authority provides the poor with the capacity to buy the BN basket, it may not achieve the minimum needs objective in terms of actual consumption of the normative quantities. This problem arises due to the differences between the planner's choice and the individual consumer's choice. The planner chooses the consumption targets (the norms) for BN goods on the basis of recommendations of technocrats as to the desired minimum consumption levels. Food targets, for example, are set at levels that provide different nutrients (calorie, protein, vitamins etc.) in adequate amounts as judged by the nutritionists.

* This chapter is a revised version of Panda (1986).

^{1/} This is the approach followed by Anand (1977), Bardhan (1973), Rudra (1974) among others. An alternative approach is to define PL as the per capita income level at which average calorie intake is equal to the minimum calorie requirement of an individual; see, e.g., Dandekar and Rath (1971); Reutlinger and Selowsky (1976). However, the problem discussed in this chapter does not arise in the calorie-oriented approach, where target is unidimensional.

The consumer, however, chooses his food intake depending upon his taste and preferences which may be based only partly on his own knowledge about nutritive value of different food items. The actual consumption levels of the BN goods may, thus, be different from the normative levels even when the consumer has acquired the capacity to afford the BN basket. This leads Lee (1977, p. 63-64) to observe: 'It is invalid to work with the technocratic principle in isolation of how absorption is to be ensured' (italics added)^{1/}.

In the literature several ways of dealing with the absorption problem have been suggested [See, e.g., Rudra (1978) and the various authors in Ghai et. al. (1977)]. Some of these are:

- i) the direct provision by the government of BN goods at normatively stipulated levels through rationing;
- ii) the manipulation of the consumption pattern, i.e. the taste and preferences, of the consumers through education, persuasion and other methods of propaganda.
- iii) the manipulation of the price system so as to induce a person with an income equal to PL to purchase precisely the normatively stipulated quantities.

^{1/} On the complete neglect of the absorption problem in Indian Plan documents Rudra says : 'Even with regard to the items that were agreed upon to constitute the food part of consumption of the target group, nothing was conceived of as to the way the target group could be made to consume those commodities in the specified quantities' (1978, p. 18).

Of the three alternative ways, the first one will mean government action beyond the market mechanism. Also mere provision by the government does not ensure consumption of the stipulated quantities, since non-drawal of full ration-quotas and trading after drawal are possibilities. The second one is not an instrument that can be used successfully in the short-run, because changes in consumers' taste and preferences take place only gradually over long periods. In this chapter we take up the third way of solving the absorption problem and determine a set of suitable prices and income that would motivate the consumer to buy the BN basket.

Section 4.2 offers a theoretical explanation of the absorption problem in terms of inappropriateness of the ruling price structure and examines some implications of different income-price strategies. Section 4.3 discusses a method of simultaneously determining the required income and price levels using Linear Expenditure System. Section 4.4 presents some numerical results for rural India. Finally, section 4.5 contains some concluding remarks.

4.2 CHOICE OF INCOME PRICE STRATEGY

In this section we examine the problem stated above for a two-commodity-case. The budget position of the consumer receiving the target level of income PL is represented by line AB in Figure 4.1, its slope giving the prevailing ratio of the prices of goods X and Y. The consumer attains equilibrium at point M where AB is tangential to the indifference curve I_0 . Normative targets for the two goods are given by point $N = (X^*, Y^*)$ which is on line AB indicating

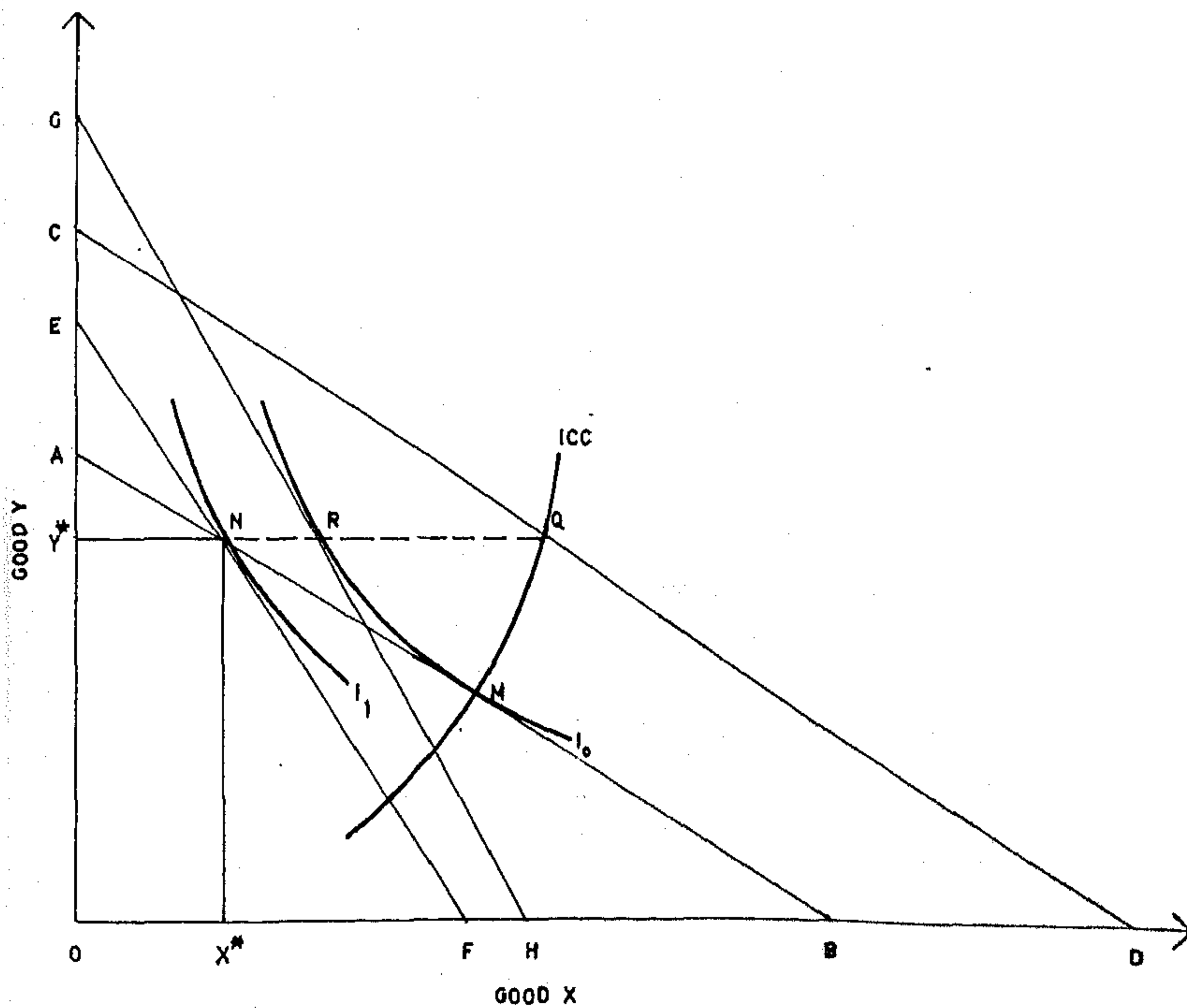


Figure 4.1

capacity of the consumer to go for normative levels of consumption. But the actual consumption of X is more than the norm whereas that of Y is less. The existing relative prices are such that the consumer's optimum allocation of his income results in a consumption pattern different from the normative one.

One can now think of a number of alternative income-price strategies to solve the absorption problem. The first method could be to keep the price-ratio at the existing level, but give the consumer enough income so that he consumes each of the commodities at least at the normative level. One such solution (involving minimum increase in income) may be represented by the line CD which is parallel to AB and passes through the point Q , where the horizontal line through Y^* meets the income-consumption curve (ICC) passing through M . Note that this will call for provision of income more than the cost of the BN basket at existing prices.

A second method could be to keep the consumer's income equal to the cost of the normative basket at existing prices, but change the relative price such that he consumes both the goods exactly at the normative levels. Let the indifference curve passing through N be I_1 and EF be tangent to I_1 at point N . The slope of EF , then, provides us the required relative price for this solution.

Note that this method entails a worsening of the individual's welfare as the consumer is seen to be at a lower level of satisfaction at point N than at point M . This is a natural consequence of the fact that the consumer attains maximum utility at point M (which is on the same budget line as N), given the ruling relative price. This,

however, need not worry us. For, the social welfare function which is implicit in the basic needs plan need not be based on utilities as perceived by individuals themselves.

However, for those who are unhappy with the reduction in individual welfare a third method could be suggested, namely, to keep the consumer's utility fixed at level I_0 , but change the relative price such that he consumes each commodity at least at the normative level. One such solution (involving minimum movement on I_0 from M) is given by the point R where the horizontal line through N meets I_0 . The slope of the budget line GH tangent to I_0 at R gives the required relative price. It may be noted here that the solution in this method cannot be obtained except with reference to the utility function of the consumer.

The solution at N is the only one involving consumption of both goods exactly at the normative level. Any other solution involves excess consumption, over the normative level, of one good and/or the other. Thus, compared to solution EF, any other solution requires the society to have more resources. It is for this reason that we shall henceforth stick to the income-price strategy as given by the line EF.

4.3 INCOME PRICE DETERMINATION METHOD

Now, we turn to a method of fixing income and price levels so that the normative levels will be just attained. Consider the linear expenditure system (LES) due to Stone (1954):

$$(4.1) \quad p_i q_i = p_i \bar{q}_i + b_i (y - \sum_{j=1}^n p_j \bar{q}_j), \quad i = 1, 2, \dots, n$$

$$b_i > 0 \quad \forall i; \quad \sum_{i=1}^n b_i = 1$$

where q_i is the quantity of consumption of the i th commodity and p_i its price; y is total consumption expenditure on all commodities; $\bar{q}_i$ is committed quantity of consumption purchased irrespective of prices; b_i is the fraction of non-committed total expenditure allotted to commodity i .

The model shows expenditure on each commodity as a function of y and all the prices. The condition $\sum b_i = 1$ ensures that expenditures on all the commodities add up to y i.e.

$$(4.2) \quad y = \sum_{j=1}^n p_j q_j$$

Substituting this value for y in (1) we have

$$(4.3) \quad p_i q_i = p_i \bar{q}_i + b_i (p_1 q_1 + \dots + p_n q_n - p_1 \bar{q}_1 - \dots - p_n \bar{q}_n)$$

$$i = 1, \dots, n$$

Now, suppose in our case normative targets have been fixed for first k commodities i.e. $q_1 = q_1^*, \dots, q_k = q_k^*$ and that $q_i^* > \bar{q}_i$ for $i = 1, \dots, k$. Let us also assume that prices of commodities $k+1$ to n are given at prevailing levels, i.e., $p_{k+1} = \bar{p}_{k+1}, \dots, p_n = \bar{p}_n$. Now, we are left with n unknowns: $p_1, \dots, p_k$ and $q_{k+1}, \dots, q_n$. But system (4.3) loses one degree of freedom due to restriction (4.2). If we take the price of one of the normative goods, say p_1 , also as given at some prevailing level and drop the first equation from (4.3), the other $n-1$ independent equations can yield solutions for $p_2, \dots, p_k$ and $q_{k+1}, \dots, q_n$.

This procedure may, however, land us in some practical difficulty regarding implementation of the targets. Consider the two-good-case with norms q_1^* and q_2^* . Suppose the first good is cereal whose present

consumption level by people at PL is very much in excess of q_1^* .

Now, if p_1 is kept fixed at prevailing level, the solution may call for very drastic reduction in prevailing level of p_2 to achieve q_1^* and q_2^* . If we permit p_1 itself to increase, then the required price change will be of a smaller magnitude to reduce q_1 from its present high level to q_1^* , as own-price-effect is likely to be stronger compared to cross-price-effect. Likewise, achievement of q_2^* would be easier if p_2 is left as a policy variable.

Thus, to get solutions for the vector $(p_1, \dots, p_k, q_{k+1}, \dots, q_n)$ we introduce one more equation into (4.3). This may take the form :

$$(4.4) \quad q_1^* p_1 + \dots + q_k^* p_k = y_{nb}^*$$

where y_{nb}^* is the known cost of the normative basket at prevailing prices. Now, replacing one of the equations (say, first one) in (4.3) by (4.4) and rearranging, we get:

$$(4.5) \quad \begin{aligned} & q_1^* p_1 + q_2^* p_2 + \dots + q_k^* p_k = y_{nb}^* \\ & \sum_{j=1}^k (b_i - \delta_{ij}) (q_j^* - \bar{q}_j) p_j + b_i \sum_{j=k+1}^n \bar{p}_j q_j = b_i \sum_{j=k+1}^n \bar{q}_j \bar{p}_j \\ & \text{for } i = 2, \dots, k \\ & b_i \sum_{j=1}^k (q_j^* - \bar{q}_j) p_j + \sum_{j=k+1}^n (b_i - \delta_{ij}) \bar{p}_j q_j = \sum_{j=k+1}^n (b_i - \delta_{ij}) \bar{p}_j \bar{q}_j \\ & \text{for } i = k+1, \dots, n \end{aligned}$$

where δ_{ij} is Kronecker delta.

These n equations may now be put in the matrix form

$$(4.6) \quad Ax = h$$

where

$$x = \begin{bmatrix} p_1 \\ \vdots \\ p_k \\ q_{k+1} \\ \vdots \\ q_n \end{bmatrix} ; \quad h = \begin{bmatrix} y_{nb}^* \\ b_2^G \\ \vdots \\ b_k^G \\ b_{k+1}^G - \bar{p}_{k+1} \bar{q}_{k+1} \\ \vdots \\ b_n^G - \bar{p}_n \bar{q}_n \end{bmatrix}$$

$$G = \sum_{k+1}^n \bar{q}_j \bar{p}_j$$

$$A = \begin{bmatrix} q_1^* & q_2^* & \dots & q_k^* & 0 & \dots & 0 \\ b_2(q_1^* - \bar{q}_1) & (b_2 - 1)(q_2^* - \bar{q}_2) \dots b_2(q_k^* - \bar{q}_k) & b_2 \bar{p}_{k+1} & \dots & b_2 \bar{p}_n \\ b_k(q_1^* - \bar{q}_1) & b_k(q_2^* - \bar{q}_2) & \dots & (b_k - 1)(q_k^* - \bar{q}_k) & b_k \bar{p}_{k+1} & \dots & b_k \bar{p}_n \\ b_{k+1}(q_1^* - \bar{q}_1) & b_{k+1}(q_2^* - \bar{q}_2) & \dots & b_{k+1}(q_k^* - \bar{q}_k) & (b_{k+1} - 1) \bar{p}_{k+1} & \dots & b_{k+1} \bar{p}_n \\ b_n(q_1^* - \bar{q}_1) & b_n(q_2^* - \bar{q}_2) & \dots & b_n(q_k^* - \bar{q}_k) & b_n \bar{p}_{k+1} & \dots & (b_n - 1) \bar{p}_n \end{bmatrix}$$

We use system (4.6) to solve for the prices of the goods for which norms have been fixed and for quantities of goods for which no norm has been fixed. Now, we define the poverty line as:

$$(4.7) \quad PL = p_1^s q_1^* + \dots + p_k^s q_k^* + \bar{p}_{k+1} q_{k+1}^s + \dots + \bar{p}_n q_n^s$$

where the superscript 's' denotes the solution value of p or $\frac{1}{q}$.

Provision of this level of income to the poor along with consumer prices $(p_1^s, \dots, p_k^s, \bar{p}_{k+1}, \dots, \bar{p}_n)$ will result in the actual consumption of the normative basket $(q_1^*, \dots, q_k^*)$, so long as the demand specification is correct.

4.4 AN APPLICATION

In this section we apply the method described above to data on rural India. For setting the normative consumption targets, we use here the recommended intake levels of various food items as given in the balanced diet basket in ICMR (1981). Table 4.1 (column 2) shows these per capita consumption norms which are averages of the recommended levels for vegetarians and non-vegetarians. Before discussing the income level and price structure necessary to ensure absorption of the ICMR norms, it may be of some interest to compare the norms with the actual consumption levels of persons at or near the conventional ^{2/}PL.

Consumption data by income or expenditure class is normally available in NSS reports in value terms and not in quantity terms. A special tabulation for National Commission on Agriculture provides both the value and the quantity data for some selected items for 1970-71. Hence, the comparison is carried out for this year for selected items.

1/ The PL as defined here is at solution or 'required' prices. To avoid confusion of such PL with those at observed prices (as in Section 4.1), we shall henceforth refer to the latter as 'conventional' PL.

2/ In chapter 1 we have made a similar comparison for 1960-61 using the consumption norms used by Rudra (1974). The comparison here is in quantity terms and for a more recent year.

Table 4.1: Comparison of Consumption Norms and Actual Consumption by Persons near Poverty Line in 1970-71.

(In Kg. per capita per month)

Item	ICMR Per Capita Consumption Norm	Actual Per Capita Consumption (by expenditure class Rs.43-55)
1-	2	3
Cereals	13.08	17.85
Pulses	1.06	1.36
Milk	6.60	4.46
Edible Oils	1.10	0.35
Sugar and gur	1.02	1.25
Meat, fish and egg	0.45	n.a.
Vegetables	4.71	n.a.

n.a. : not available.

Sources : col. 2 : ICMR (1981)

col. 3 : National Sample Survey Report No. 250
(Special Tabulation for National Commission on Agriculture).

In order to compute the cost of the ICMR basket we have derived the unit prices for 1970-71 as implied by the value and quantity of NSS consumption data. For some items, e.g. vegetables and meat-fish-egg, quantity figures are not available and average rural retail prices compiled by NSS have been used. Since in NSS expenditure data, the cash purchased part is evaluated at retail prices but home grown part is evaluated at ex-farm prices, we have, following Bardhan (1973), reduced the retailed prices by 15% to get the appropriate average prices for our purpose. Using these prices, the cost of the ICMR balanced diet basket is obtained as Rs.31.98 (per capita per month). The corresponding estimate of conventional PL turns out to be Rs.49.95. Table 4.1 (column 3) shows the actual quantities of consumption by rural expenditure class Rs.43-55 which contains this PL.

A comparison of column 3 with column 2 of Table 4.1 reveals that in 1970-71 people near conventional PL actually consumed cereals, pulses, and sugar and gur more than their respective normative levels. The excess consumption was as high as 36 per cent in case of cereals. But the actual consumption of some other items fell short of the recommended levels by a considerable amount, the short-fall being about one-third for milk and about two-thirds for edible oil. We may note here that even some expenditure classes below PL consumed cereals more than the norm while some expenditure classes above PL did not meet the norms for items like edible oil.

The ICMR balanced diet is meant for application at all-India level and it does not distinguish between rural and urban requirement. As such the appropriate rural norms would be somewhat different from

the ones considered here.^{1/} Nevertheless, the differences between the ICMR norms and the actual consumption levels are so large that Table 4.1 provides prima-facie evidence of existence of the absorption problem in the Indian economy.

Turning next to solution of the required price structure, we have taken the LES parameter estimates for the poor income group as in PPD (1979). These estimates have been derived by applying the Newton Raphson method to time series of cross section data from several rounds of NSS consumer expenditure surveys. The parameter $\bar{q}$'s as estimated in PPD (1979) are at 1976-77 prices and these have been converted to 1970-71 prices using wholesale price indices of relevant items. While solving equation system (4.6), the q 's and $\bar{q}$'s are understood as value of quantity of consumption at observed 1970-71 prices and the p 's are understood as ratio of required prices to observed prices. This convention is adopted because of difficulties in obtaining absolute unit prices for non-BN items. Under this convention the assumption that prices of non-BN items are given at observed levels (Section 4.3) would mean $\bar{p}_{k+1} = \dots = \bar{p}_n = 1$. The ICMR consumption norms have been turned to value terms (at 1970-71 prices) using the NSS unit prices discussed earlier.

Table 4.2 (column 2) shows the ratio of required prices to observed price for BN items obtained from solving equation system (4.6). The actual prices prevalent in 1970-71 are given in the next

^{1/} The distinction between rural and urban requirement is made in chapter 6 in a more general framework.

Table 4.2: Comparison of Required Prices with Observed Prices in 1970-71.

Item	Ratio of required price to observed price	Unit Prices ^{1/}		Relative Prices ^{2/}	
		Observed	Required	Observed	Required
1	2	3	4	5	6
Cereals	2.0191	0.91	1.84	0.0648	0.2283
Pulses	1.1704	1.36	1.59	0.0968	0.1973
Milk	0.3046	1.02	0.31	0.0726	0.0385
Edible oils	0.2048	5.31	1.09	0.3779	0.1352
Sugar and gur	0.8179	1.26	1.03	0.0897	0.1278
Meat, Fish & Egg	0.5629	3.51	1.98	0.2498	0.2457
Vegetables	0.3185	0.68	0.22	0.0484	0.0273

Notes: ^{1/} Unit prices in Rs. per kg.

^{2/} Relative prices with column sums as one.

column of this table. The required absolute unit prices are presented in column 4. The expenditures on BN and non-BN items work out to Rs.31.98 and Rs.9.62 respectively, giving us PL as defined by (4.7) to be Rs.41.60. If a poor person's income is raised upto this level and the prices he faces are the same as in column 4 of Table 4.2, he would consume the BN items at the stipulated normative levels.

By keeping the cost of the normative basket at solution prices same as that at prices observed in 1970-71, we have aimed at obtaining a PL which is not very different from the conventional one. Differences between our PL and the conventional PL occur due to expenditure differences on non-BN items. But since the demand functions are homogenous of degree zero, the quantities demanded will not change if all prices and income are changed by the same factor. The above income-price solutions are, thus, unique upto a scalar multiple.

The observed and required relative prices are shown in the last two columns of Table 4.2 with the sum of BN prices as unity. The results suggest the need for a change in price structure in order to solve the absorption problem.^{1/} The relative prices of foodgrains and sugar need to be increased from their prevailing levels and those of other food items should decline. As seen in Table 4.1 consumers at (or around) conventional PL consume foodgrains and sugar more than the

^{1/} When the problem does not exist, i.e. the normative levels are actually consumed, the model solution would simply reproduce the observed prices.

normatively required levels but they do not meet the norms for other food. Hence, the above movement in relative price takes place so that foodgrains and sugar are substituted by rest of the BN items. The change in relative prices is particularly substantial for cereals, edible oils, milk and vegetables.

4.5 CONCLUSION

In this chapter we have argued that provision of income to the poor people by itself is not sufficient to induce them to consume a basic need basket. Our approach to ensure absorption of the BN basket postulates freedom of choice of the consumers and selects an income-price strategy that makes the least demand on society's resources. The income-price solution method discussed above assumes that the consumer follows the behaviouristic pattern incorporated in LES. But the approach of obtaining the solution could be adopted taking other expenditure systems as well.

LES has been found to fit well to Indian data (Radhakrishna et.al., 1979). It has been used by fixed price plan models (PPD, 1981, 1986) and by price endogenous general equilibrium models for India (Taylor, 1983; Narayan et.al., 1988). It is a complete demand system derivable from Stone-Gary type loglinear utility function and satisfies, inter alia, the property of Engel aggregation. Since marginal propensities to consumer (b_i) are positive for all items in LES, the consumption of an item - behaviouristic or normative - must be higher than the floor consumption level ($\bar{q}_i$). The adoption

of LES, thus, imposes a restriction that the norm q_i^* should be greater than $\bar{q}_i$ for all BN items. This restriction is similar to the one that LES cannot deal with inferior goods. In practice, q_i^* turns out to be considerably higher than $\bar{q}_i$ as may be seen from the following comparison (at 1970-71 prices).

Item	q_i^*	$\bar{q}_i$
Cereals	11.90	5.07
Pulses	1.44	0.12
Milk	6.73	-0.11
Edible oils	5.84	0.19
Sugar	1.29	0.07
Meat-fish-egg	1.58	0.10
Vegetables	3.20	0.22

It may also be noted that LES price elasticity cannot be estimated independently of income elasticity, as there is a linear relationship between the two implied by the underlying additive preference ordering. To get rid of this problem, one may use the modified LES advocated by Deaton (1975) or some other system that does not a priori imply any such relationship between the income and price elasticities.

The framework for obtaining the income-price solution discussed here has, however, a few unsatisfactory aspects: (1) It starts with exogenously given consumption norms and determines the prices required to meet the norms. The feedback from the prices to the norms is absent. As we shall see in the next chapter, there is a good reason to introduce this feedback. (2) It assumes

a sort of dichotomy between the BN and non-BN prices, since it considers changes in BN prices but assumes non-BN prices as given. An appropriate link between BN and non-BN prices should be brought out. In the following chapter we attempt to remove these shortcomings and incorporate the BN basket within the framework of a plan model.

Chapter 5

A PLAN MODEL INCORPORATING NORMATIVE MINIMUM CONSUMPTION TARGETS

5.1 INTRODUCTION

In this chapter we attempt to introduce a normative consumption basket into a plan model. This issue inevitably involves the problem of absorption of the basket by the consumers. The previous chapter describes a method of dealing with this problem by determining a set of prices which, together with an income level PL , could induce the consumers to adopt a normative consumption pattern. At the end of that chapter, we had mentioned two aspects that were not satisfactory. First, the consumption norms were treated as given targets independent of the prices. The norms, however, may be affected by prices as in the case of a balanced diet basket obtained as the least cost solution in a typical diet problem exercise in linear programming. In such a case it is essential to have a feedback from the price solution to the normative targets. Thus, the consumption norms and the prices should be viewed in an integrated manner because of their interdependence.

Secondly, the last chapter assumes prices of non-BN goods are exogenously specified. This was not satisfactory in that changes in prices of BN goods would in general affect the prices of non-BN goods too. Hence, it would be appropriate to consider a price determination system along with the demand system of the last chapter.

This chapter considers the absorption problem in a broader perspective with specific attention to these two points. The overall

aim is to develop a framework integrating the consumption norms, the corresponding price structure and the PL along with the conventional consumption and output structure usually discussed in a plan model. Such a frame is suitable for examining the implications of fixing consumption targets on a normative basis for certain target groups of the population.

In section 5.2 we discuss at length the model structure integrating consumption norms, the prices and the poverty line. These are then incorporated in section 5.3 into a standard plan model relating to structure of consumption, investment and output. Sections 5.2 and 5.3 together produce a price endogenous plan model incorporating normative consumption targets. Section 5.4 concludes the chapter indicating limitations and possible extension.

5.2 CONSUMPTION NORMS, PRICE STRUCTURE AND POVERTY LINE

The structure of the model is discussed in five different blocks in this and the following sections. The blocks are related and each describes one aspect of the overall problem. As in the last chapter, there are n sectors in the economy. The first k sectors produce BN goods and minimum consumption targets are fixed for these goods. Sectors $k+1$ through n produce non-BN goods. The BN sectors are confined to food items for reasons discussed earlier.

Block I: Least Cost Balanced Diet Basket

The first problem relates to determination of consumption norms or targets for various food items. Two criteria based on nutrition

and cost guide us to select the food basket for this purpose: (1) the food basket should be a balanced one in that it satisfies the constraints on the various nutrients like calorie, protein and fat (2) among the several feasible balanced diet baskets, the one that is associated with the minimum cost should be chosen. We thus have a standard optimisation problem:

Minimise

$$(5.1) \quad Y_n = \sum_{i=1}^k P_i q_i$$

Subject to

$$(5.2) \quad \sum_{i=1}^k n_{ji} q_i \geq z_j$$

(For notation, see glossary at the end of the chapter).

Minimisation of the cost of the food basket given in (5.1) defines the objective function of the program so that the selected basket should correspond to the minimum cost. The nutrient coefficients (n_{ji}) are used in (5.2) to compute amounts of the different nutrients that could be derived from the food basket. A particular nutrient derived from all items in the basket should be at least at the level z_j , which is the desirable minimum^{1/}. Values of n_{ji} and z_j are based on recommendations by nutritionists and are exogenous to our system. In this block we

^{1/} For some nutrients it may be desirable to put a maximum limit too. More discussion on this point appears in the next chapter and the appendix.

determine the optimum consumption levels $(q_1^*, \dots, q_k^*)$ that constitute the least cost balanced diet basket. The price levels (P_i) relevant for cost computation are determined in the following block.

Block II: BN Prices and Poverty Line

Here we determine an income level PL that will provide the consumer with the capacity to buy the balanced diet basket estimated above. At the same time, we determine prices of BN goods at which a typical consumer with adequate income consumes various food items in the balanced pattern. The exercise is carried out using the method followed in the last chapter (Section 4.3). The specification of the essential equations runs as follows:

$$(5.3) \quad P_i q_i^* = P_i \bar{q}_i + b_i \left(PL - \sum_{j=1}^n P_j \bar{q}_j \right) \quad i = 1, \dots, k$$

$$(5.4) \quad P_i q_i = P_i \bar{q}_i + b_i \left(PL - \sum_{j=1}^n P_j \bar{q}_j \right) \quad i = k+1, \dots, n$$

$$(5.5) \quad \sum_{i=1}^k P_i q_i^* = Y_n^*$$

$$(5.6) \quad PL = \sum_{i=1}^k P_i q_i^* + \sum_{i=k+1}^n P_i q_i$$

The first two equations describe consumer behaviour at the poverty line through LES. Per capita consumption of a good (q_i or q_i^*) is a function of income (PL in this case) and prices of all goods. Use of LES imposes the restriction that normative consumption level

is higher than the floor consumption level i.e. $q_i^* > \bar{q}_i$. Restriction (5.5) is similar to that in equation (4.4). But the cost of the basket Y_n^* is now taken as the optimum level of Y_n determined in Block I, whereas in the previous chapter it was exogenously fixed using observed prices.^{1/} Finally, (5.6) defines PL as the total per capita expenditure that permits consumption of BN goods at normative levels and of non-BN goods at levels estimated through LES.

The equations in this block are used to determine prices of BN goods ($P_1, \dots, P_k$), consumption levels of non-BN goods ($q_{k+1}, \dots, q_n$) and PL. The equations in (5.3) and (5.4) lose one degree of freedom as mentioned before. The basket ($q_1^*, \dots, q_k^*$) is determined in block I and non-BN prices ($P_{k+1}, \dots, P_n$) are estimated in block III below. The equation system in this block could be solved by the reduced form in equation (4.6). (Parameter b_i in this block is same as b_{1i} in block IV).

Block III: Non-BN Prices, Wages and Taxes

This block deals with the structural equations relating to price and wage formation. Kaleckian type cost based price formation rules are followed here. Prices of various sectors depend on one another through the material cost and wage elements. The wages

^{1/} This restriction is not necessary if we solve for relative prices, see Section 4.3.

exert influence on and are influenced by the prices. The equations constituting this block are:

$$(5.7) \quad P_i = \left(\sum_{j=1}^n a_{ji} P_j + w_i l_i \right) (1 + \tau_i) (1 + t_i) \quad , i = 1, \dots, n$$

$$(5.8) \quad w_i = \alpha_{wi} + \beta_{wi} \text{CPI} + \gamma_{wi} T \quad , i = 1, \dots, n$$

$$(5.9) \quad \text{CPI} = \sum_{i=1}^n \theta_i P_i$$

Unit prime cost consisting of material input cost and wage bill is inflated by mark up rate (τ) and indirect tax rate (t) to form market price of a sector in equation (5.7). Price of one sector depends directly on that of another sector, if the latter supplies material input to the former. Indirect dependence may occur through input linkage in the second or subsequent rounds. It may also occur through the wage rate, which is linked to consumer price index (CPI) and to a time trend (T). CPI is constructed in (5.9) as a weighted sum of sectoral prices, the weights being the share of a sector in total consumption expenditure in the base year. The coefficient β_{wi} in (5.8) represents wage indexation coefficient with respect to CPI, while γ_{wi} reflects influence on wage rate of other factors related to time like annual increments. While operating the model relation (5.8) was estimated only for two broad sectors, agriculture and industry, due to data problem.

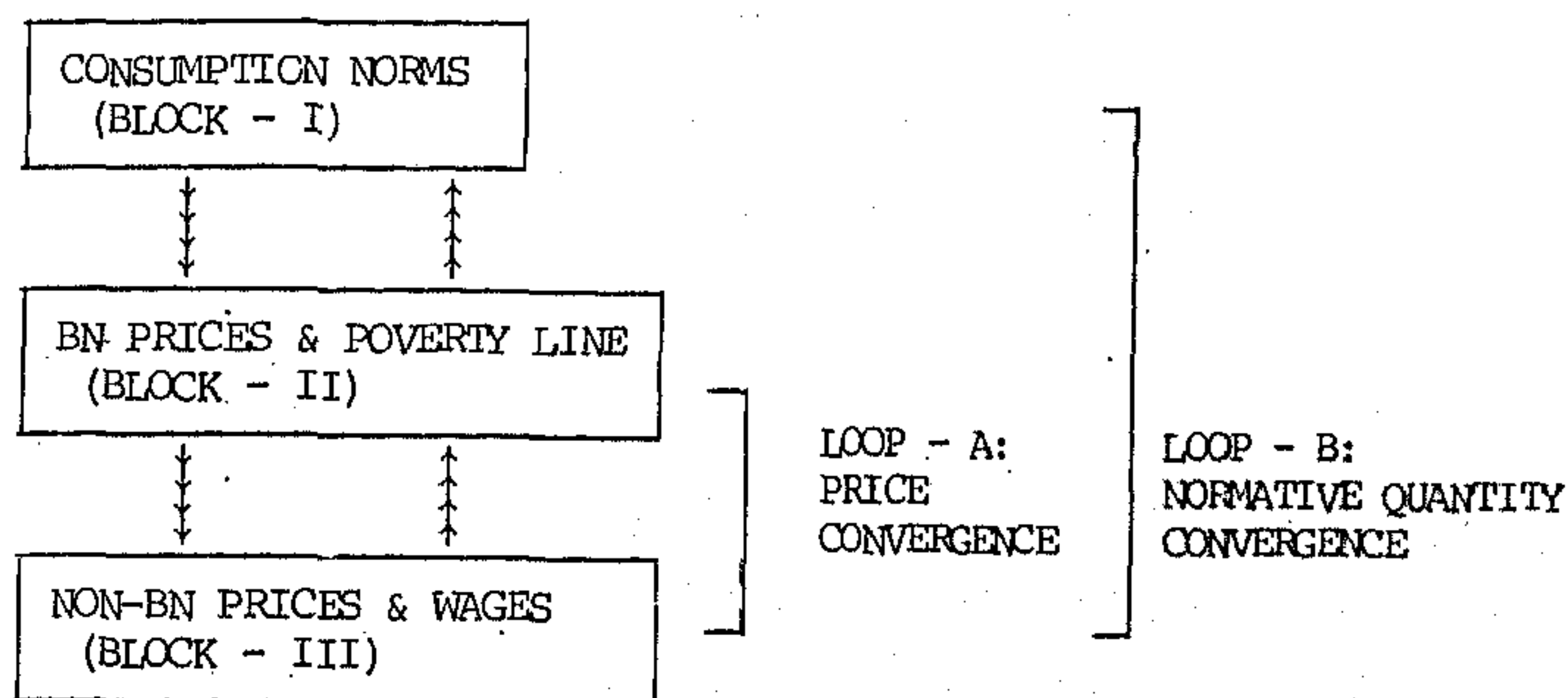
Since prices of BN goods are already determined in block II, relation (5.7) is used to compute prices of non-BN goods ($P_{k+1}, \dots, P_n$) and tax rates of BN sectors ($t_1, \dots, t_k$). Thus, apart from non-BN prices, we determine here the tax or subsidy (negative t_i) implications of the BN prices estimated in the previous block after taking into account the cost-push factors due to change in various sectoral prices and wages. The tax rates of non-BN sectors and mark up rates of all sectors are exogenously specified.

One may argue that indexation of wage rate to consumer price is a rule followed in the organised industrial sector and this rule is not an appropriate specification for the agricultural sector in India. But the error, if any, due to this specification will generally not affect the computation of prices in the above frame. Most of the agricultural sectors would be covered by the BN sectors whose prices are determined in block II. Since equation (5.7) is not used to compute BN prices, any specification error in wage rate of BN agricultural sectors would be reflected in computation of corresponding tax or subsidy rates.

Linkages Among Blocks I, II and III

The first three blocks described above are dependent on each other and form an overall simultaneous system to determine the normative consumption basket and the required price structure and income level to ensure consumption of the basket. Block I determines the norms ($q_1^*, \dots, q_k^*$) which are used in block II to estimate the BN prices ($P_1, \dots, P_k$) and the income level PL. The BN prices affect computation of non-BN prices through material costs and wage rates in

block III. The non-BN prices in turn are used in block II, because LES considers all the prices. The BN prices feed back into block I for solution of the normative basket, which completes the chain of linkages. The interlinkage of the three blocks may be shown as follows:



In view of the above interlinkage, we solve the three blocks using an iterative process with two loops. Starting with some initial consumption norms (a known balanced diet basket) and observed cost, loop A, consisting of blocks II and III is solved till each of the prices converge to the same value in successive iterations. Next, we go back to revise the consumption norms with the new BN prices. The revised norms are used again to solve loop A. The process of revision of the norms continues till they converge in loop B. Each iteration of loop B contains a solution of loop A.

Several features of the structure outlined earlier should be noted. First, while the last chapter dealt with the absorption problem when the balanced diet basket was exogenously specified, we integrate

here the diet problem and the absorption problem in a common framework by solving them simultaneously in blocks I and II above. Secondly, the interdependence between the BN and non-BN prices are taken into account through the cost structure. In the process, we also determine the tax or subsidy rates on the BN goods if the required consumers' prices were to prevail in the market.

Thirdly, in constructing poverty line it is not necessary here to use some 'blowing up' factor from past consumer behaviour on the cost of BN basket. When consumers at PL change their consumption pattern in favour of the BN basket, the blowing up factor is also likely to change. The use of a total demand system like LES enables us to determine consumption levels of the non-BN goods that would correspond to consumption of the BN basket. The sum of expenditure thus derived on BN and non-BN goods defines our poverty line.

Lastly, if the poor persons' incomes are raised upto the PL and they face prices as estimated in this section, they would consume the balanced diet basket. Thus, in order to introduce normative minimum consumption targets into the conventional structure of a plan model, it would be sufficient to introduce the income target PL and the required structure of prices as attempted in the following section.

5.3 CONSUMPTION AND OUTPUT STRUCTURE

This section deals with model specification relating to consumption, investment and output determination. There are two blocks here (blocks IV & V). The first one uses the PL and prices to

estimate aggregate private consumption and its sectoral composition corresponding to provision of normative consumption basket for a certain specified target group. Block V relates to an open loop Leontief model to analyse production structure to meet the consumption vector. The blocks in this section are recursive in nature, whereas those in the earlier section were interdependent. The recursive system in particular implies the absence of feedback from output structure to consumption structure, which is characteristic of the open loop system. There is also no feedback from section 5.3 as a whole to section 5.2 i.e. from production structure to price structure. It may also be mentioned that block II considers consumer behaviour at a particular income level PL, whereas block IV below considers consumer behaviour of different income (expenditure) groups and arrives at sectoral consumption levels of the entire population in the economy.

Block IV: Private Consumption

There are two major steps in this block: (a) estimation of per capita private total consumption expenditure (PCE) of the entire population corresponding to a given target regarding incidence of poverty; (b) sectoral breakdown of PCE. Often a few income classes are considered in step (b) to improve precision because consumer behaviour differs considerably across income classes.

In the first step, size distribution of PCE is assumed to follow two parameter log normal distribution with mean μ and standard deviation λ . A convenient feature of the lognormal distribution is that parameter λ is uniquely related to Lorenz ratio (L)

and so it is a measure of inequality. The relation between λ and L is given by:

$$(5.10) \quad L = 2 \phi(\lambda/\sqrt{2}) - 1$$

where $\phi(.)$ = probability integral of standard normal distribution.

Now, given a poverty target (POVT) in the form of proportion of people below PL and exogenous specification of L , the mean PCE of the entire population ($\bar{x}$) is determined using (5.10) and the following two equations:

$$(5.11) \quad \text{POVT} = \phi(Y_p)$$

$$(5.12) \quad Y_p = \frac{1}{\lambda} \text{Log}(PL / \bar{x}) + \frac{\lambda}{2}$$

Here, Y_p is the value of standard lognormal variate that corresponds to PL. To derive the relationship between Y_p and PL as given in (5.12), we have by definition of standard lognormal variate:

$$(i) \quad Y_p = (\text{Log PL} - \mu) / \lambda$$

Also in case of lognormal distribution $\bar{x}$ is given by:

$$(ii) \quad \bar{x} = e^{\mu + \lambda^2 / 2}$$

Putting value of μ from (ii) in (i) we get equation (5.12).

Since POVT equals area below Y_p in standard normal curve, we may estimate Y_p using (5.11) as $\phi^{-1}(\text{POVT})$ i.e. point in abscissa of standard normal curve below which area is POVT. Once Y_p is known,

we estimate $\bar{x}$ using relation (5.12) i.e.

$$(iii) \quad \bar{x} = PL/e^h \text{ where } h = \lambda Y_p - (\lambda^2/2)$$

Next, PCE of relevant income classes may be obtained.

We consider two income groups (in both rural and urban areas), namely, people below PL and above PL. Under lognormal assumption, their PCE levels $\bar{x}_1$ and $\bar{x}_2$ are:

$$(5.13) \quad \bar{x}_1 = \bar{x} [\phi(Y_p - \lambda) / \phi(Y_p)]$$

$$(5.14) \quad \bar{x}_2 = \bar{x} [1 - \phi(Y_p - \lambda)] / [1 - \phi(Y_p)]$$

The expression $\phi(Y_p - \lambda)$ gives the share of people below PL in aggregate private consumption expenditure and $1 - \phi(Y_p - \lambda)$ gives the share of people above PL.

The sectoral breakdown of private consumption for the two income classes are obtained using separate LES parameters for each class.

$$(5.15) \quad C_{1i} = \bar{q}_{1i} + \frac{b_{1i}}{P_i} (\bar{x}_1 - \sum_{j=1}^n \bar{q}_{1j} P_j), \quad i = 1, \dots, n$$

$$(5.16) \quad C_{2i} = \bar{q}_{2i} + \frac{b_{2i}}{P_i} (\bar{x}_2 - \sum_{j=1}^n \bar{q}_{2j} P_j), \quad i = 1, \dots, n$$

The sector-wise per capita consumption levels of the two groups are then added up, after being multiplied by respective population weights, to get sectoral private consumption of entire population.

$$(5.17) \quad C_i = C_{1i} \cdot \phi(Y_p) \cdot N + C_{2i} [1 - \phi(Y_p)] \cdot N, \quad i=1, \dots, n$$

This C_i feeds into the input-output block discussed below. The price levels as determined in the earlier section are used in (5.15) and (5.16) above. People above and below PL are assumed to face the same set of prices.

Since there is a great deal of difference in consumption pattern between rural and urban areas in India, it is customary to analyse consumer behaviour and related studies separately for rural and urban population. The consumer expenditure data & parameter estimates based on it are available for each of the two areas. Hence, in the empirical use of the model, we solve all the above blocks (I through IV) for both the areas. The consumption norms, the prices, the poverty line and the consumption pattern - all differ between rural and urban areas.

Block V: Input - Output Relations

This block determines output levels in an input-output framework by considering intermediate and final demand elements. Since private consumption, the principal final demand component, is pre-determined in the preceding block, the basic characteristics of the model are those of an open-loop type. Investment and some other final demand elements are specified endogenously. The equations in the block are the following:

$$(5.18) \quad X_i = \sum_{j=1}^n a_{ij} X_j + C_i + G_i + E_i + I_i + \Delta S_i - M_i, \quad i=1, \dots, n$$

$$(5.19) \quad M_i = m_i X_i \quad , i=1, \dots, n$$

$$(5.20) \quad \Delta S_i = s_i X_i \quad , i=1, \dots, n$$

$$(5.21) \quad V_i = v_i X_i \quad , i=1, \dots, n$$

$$(5.22) \quad U_i = \alpha_{Ii} + \beta_{Ii} \cdot V_i + (k_i/L_i) \\ [(1 + R_i)^{L_i} - 1] V_i \quad , i=1, \dots, n$$

$$(5.23a) \quad I_i = \sum_1^n U_i \text{ for } i = c \text{ (Capital goods sector)}$$

$$(5.23b) \quad I_i = 0 \quad \text{for } i \neq c$$

Output levels are determined by commodity balance equations in (5.18). Supply (output) adjusts to demand in all sectors. Government consumption (G_i) and exports (E_i) are exogenously specified. Imports (M_i), fixed investment (I_i) and changes in stock (ΔS_i) are related to output in equation sets (5.19) through (5.23). Imports and changes in stock are linked to output levels through fixed coefficients. The sectoral real income levels (V_i) are obtained from output levels using value-added output ratios of base year (v_i). Investment requirement by sector of destination (U_i) consists of replacement investment, net investment and an intercept term in (5.22). The replacement part is considered through fixed coefficient of income of the sector. Net fixed investment is considered through a multi-sector version of the accelerator principle. If L_i is the investment - output gestation lag of i^{th} sector, the net investment in this sector in target year T is specified to be a

function of increases in output of the sector in each of the years between $T + 1$ and $T + L_i$. Under the assumption that investment is equally disbursed over the gestation years, net investment demand of sector i in year T may be written as: [see, PPD (1981) for details]

$$\frac{k_i}{L_i} (V_i^{T+L_i} - V_i^T) = \frac{k_i}{L_i} V_i^T [(1+R_i)^{L_i} - 1]$$

which is the last term in (5.22) omitting the time superscript T . Here, k_i is capital value-added ratio and R_i is post target year growth rate (discussed below). The use of capital value-added ratio rather than the more familiar capital - output ratio is due to the fact that time series data on output for many sectors are not available in India.

Finally, turning to investment by origin, we consider only one capital goods producing sector. Investment by origin of this sector (I_C) is sum of investment by destination (U_i) of all the sectors. Thus, for the capital goods producing sector $I_i = I_C$ and for all other sectors $I_i = 0$.

Intertemporal Linkage

Upto now we have presented the model for a single time period. In the next chapter the model is used to analyse empirical results for two terminal years: the fifth year and the fifteenth year from the base year 1984-85. The use of the

model for two periods requires specification of an intertemporal linkage present in the model. The output levels involve an intertemporal element, namely, the post terminal growth rate (R_i) that appears in the investment equation. Consideration of two periods (0-5 and 5-15 years) helps us to specify the post terminal condition of the first period through model solutions of the second period. The investment need of the fifth year is thus related to output growth rates between fifth and fifteenth years. Since post-fifteenth year output conditions are not available, the post-fifteenth year output growth rates are specified to be certain fixed proportion of growth rates during the period 5-15 years. The specification on R_i takes the following form:^{1/}

$$(5.24) \quad R_i^5 = (X_i^{15} / X_i^5)^{1/10} - 1, \quad i = 1, \dots, n$$

$$(5.25) \quad R_i^{15} = F \cdot R_i^5, \quad i = 1, \dots, n$$

where the superscripts refer to the terminal years and F is a given value.

The output growth rates during 5-15 years in equation (5.24) feedback to determine fifth year output level, which then feed forward through (5.25) to solve for fifteenth year output levels. Because of this intertemporal linkage, it is necessary to test for convergence of the growth rate vector R^5 apart from the usual convergence of output vectors (X^5 and X^{15}) in input-output models.

^{1/} A similar specification appears in Panda and Majumdar (1983).

Solution Procedure

The model is solved by an interwoven system of Gauss-Siedel iteration routine. The iterative loops for blocks I to III are already described in section 5.2. The equations in block IV could be arranged sequentially and so an iterative process is not necessary to solve them. Absence of any intertemporal dependence makes it possible to get solution for the endogenous variables in blocks I through IV for the 5th and the 15th years separately. Unlike these variables, the output vectors of the two target years are interdependent. The following steps were adopted to solve the output systems of 5th and 15th years:

- (i) Start with some guess values for the two output vectors X^5 and X^{15} . The base year output vector inflated by some expected factor is good enough for this purpose.
- (ii) Estimate R^5 , V^5 , I^5 , M^5 and ΔS^5 corresponding to guess vector X^5 .
- (iii) Using these estimates as well as the predetermined vector C^5 and exogenous variables E^5 and G^5 , get the solution for X^5 .
- (iv) Go back to step (ii) with the new X^5 replacing the old X^5 and repeat the steps (ii) to (iv). Continue the repeatation process till X^5 vector converges element by element.
- (v) Next, go to 15th year model and solve for X^{15} in the same way as for X^5 .

(vi) Using the latest values of x^5 and x^{15} , get new estimate of R^5 and go back to solve for both x^5 and x^{15} again. This process is continued till R^5 itself converges.

Upto step (v), solution of either x^5 or x^{15} is obtained assuming the other as given. In step (vi) the interdependence between both is considered and intertemporal consistency is tested by convergence of the post terminal growth rate vector R^5 . Each loop of R^5 envelops solutions of x^5 and x^{15} .

List of endogenous variables

The following is a list of endogenous variables in the model.

<u>Endogenous Variables</u>	<u>Nb.</u>	<u>Description</u>
$q_1^*, \dots, q_k^*, q_{k+1}, \dots, q_n$	n	Per capita consumption at PL
$p_1, \dots, p_n, \text{CPI}$	n+1	Sectoral prices, consumer price index
$w_1, \dots, w_n$	n	Wage rates
$t_1, \dots, t_k$	k	Tax or subsidy rates on BN goods
PL, Y_n^*	2	Poverty line & cost of normative basket
λ, Y_p	2	Log normal standard deviation and point corresponding to PL
$\bar{x}, \bar{x}_1, \bar{x}_2$	3	PCE levels
C_i, C_{1i}, C_{2i}	3n	Sectoral consumption
X_i, V_i	2n	Sectoral output & income
$M_i, \Delta S_i, U_i, I_i$	4n	Sectoral imports, stock changes & investment
R_i	n	Post terminal growth rates
13n + k + 8		

There are altogether $13n + k + 8$ endogenous variables. Of these, $k+1$ variables ($q_1^*, \dots, q_k^*$ and y_n^*) are determined by Linear programming in block I. The rest $13n + 7$ variables are determined by the equations in block II through V. The corresponding blockwise independent equations are:

<u>Block</u>	<u>No. of independent equations</u>
II	$n + 1$
III	$2n + 1$
IV	$3n + 5$
V	$7n$
	$13n + 7$

Blocks I to IV are solved for both rural and urban areas and Block V for national level in each period.

Flow Diagram

A flow diagram of the model showing linkages among the major variables as discussed in this chapter is depicted in Figure 5.1. Targets for the terminal year of the plan are fixed in terms of minimum nutrition levels and percentage of people availing them (or, percentage of poor who are deprived of the minimum levels). The principal exogenous variables are the Lorenz ratio, mark-up rates, government consumption and exports. Given the exogenous variables, the nutritional targets are the main driving forces in the model.

5.4 CONCLUSION

To sum up, this chapter provides a framework for analysing implications of setting normative consumption targets for certain target groups of the population. We first determine the balanced diet basket, and the price structure and income level necessary to consume the basket within an integrated structure. The classical diet problem exercise assumes prices as given and solves for the least cost balanced diet basket satisfying the nutritional constraints. It leaves out the problem of absorption of the basket by the consumers. The last chapter approaches the problem by looking for an income-price strategy to ensure absorption, but assumes the diet basket as given. Since the basket and the prices are interlinked, our approach here has been to solve the diet problem and the absorption problem in an integrated manner. The prices at which the diet problem is solved are such that the consumer consumes the balanced diet basket. In the process we also determine the necessary tax and subsidy rates on BN goods, if the required consumers' prices were to prevail in the market.

Secondly, the price structure and the income level (PL) determined above are introduced into a conventional plan model. Starting with a specified target on percentage of people below PL, the mean private consumption of the population is obtained with the inequality parameter given exogenously. The earlier price structure is used to estimate the sectoral private consumption structure corresponding to normative minimum targets for the target group.

The framework developed in this chapter has some limitations which may be removed through further extensions. First, the Lorenz ratio is given exogenously. To the extent that the structure of production itself determines Lorenz ratio, the effect of production on consumption is ignored. A closed loop formulation would help us to consider such effects. Secondly, although prices play a major role in determining the private consumption vector, they do not influence other final demand vectors. The model structure may be extended by introducing behavioural relations for exports etc. so as to capture the price effects. While such extensions may be useful to study specific issues related to these final demand elements, our focus in this study is on private consumption and other final demand vectors are specified in a simple manner.

Lastly, an important question naturally arises: will the required output be supplied? Because the price structure is changed so as to motivate consumers to adopt a specific consumption pattern, it is important to know how the producers would respond to the changed prices. In applying the cost based price formation rules in block III, we have exogenously fixed the mark-up rates. An implicit assumption is that the required supply will be forthcoming at the given mark-up rate (say, as estimated from the base year data set). Thus, even when the consumers' price of a sector falls from the prevailing level, the mark-up rate of the producer is protected.

It may, however, be necessary to provide higher mark-up rates to producers of some BN goods so that they produce the necessary output levels. The framework developed here needs to be extended to incorporate such supply side response. Note that the BN consumers' prices are determined in block II where the mark-up rates do not have any role. As such, increase in mark-up in BN sectors will not affect the consumers' prices and the corresponding required private consumption and output vectors (see, chapter 6). Hence, notwithstanding the absence of producers' response functions, the framework developed in this chapter is suitable to examine the implications of basic need targets on consumers' prices, consumption, output and income. In the next chapter, we turn to empirical examination of such implications for India.

Glossary

A. Variables

C_i	=	Sectoral private consumption expenditure
C_{1i}	=	Sectoral per capita consumption expenditure of people below PL
C_{2i}	=	Sectoral per capita consumption expenditure of people above PL
CPI	=	Consumer price index
E_i	=	Sectoral exports
I_i	=	Investment by sector of origin
L	=	Lorenz Ratio
M_i	=	Sectoral imports
N	=	Total population
P_i	=	Sectoral price level
PL	=	Poverty line
POVT	=	Target on proportion of people below PL
q_i	=	Sectoral per capita consumption (quantity)
q_i^*	=	Normatively fixed sectoral per capita consumption (quantity)
R_i	=	Post terminal period sectoral growth rate
ΔS_i	=	Changes in sectoral stock
T	=	Time trend
t_i	=	Sectoral indirect tax rate

U_i	= Investment by sector of destination
V_i	= Sectoral value added
W_i	= Sectoral wage rate
X_i	= Sectoral output
$\bar{x}$	= Per capita total consumption (on all items)
$\bar{x}_1$	= Per capita total consumption of people below PL
$\bar{x}_2$	= Per capita total consumption of people above PL
Y_n	= Cost of normative basket
y_p	= Point in abscissa of standard normal curve below which area is POVT
Z_i	= Per capita minimum requirement of nutrient i
λ	= Standard deviation of lognormal distribution
τ_i	= Sectoral mark-up rate

B. Parameters

a_{ij}	= Input output coefficient indicating flow from sector i per unit output in sector j
b_i	= Marginal propensity to consume in LES
k_i	= Capital value-added ratio
L_i	= Gestation lag in investment
l_i	= Labour output ratio
m_i	= Import output ratio

- n_{ij} = Amount of nutrient i per unit of commodity j
 $\bar{q}_i$ = Floor consumption in LES
 s_i = Stock change to output ratio
 v_i = Value-added output ratio
 α_{wi} = Intercept term in wage equation
 β_{wi} = Wage indexation coefficient with respect to CPI
 γ_{wi} = Coefficient of time trend in wage equation
 α_{Ii} = Intercept term in investment equation
 β_{Ii} = Replacement coefficient in wage equation
 θ_i = Consumption weight in CPI
 $\phi(y)$ = Area below point y in standard normal curve.

Chapter 6

EMPIRICAL OPERATION OF PLAN MODEL

In this chapter we apply the model developed in the previous chapter to examine the implications of fixing normative consumption targets for the rural and urban population in India. The operation of the model involves estimation of a number of technical and behavioural parameters. Given the estimated values of the parameters and the specified levels of the exogenous variables, the model produces an internally consistent set of values for the endogenous variables, which are the model results. The empirical results under several alternative scenarios are analysed in section 6.2. But before taking up the results, we describe the method of parameter estimation in section 6.1, while the estimated value of the parameters are given in the Appendix with some explanatory notes.

6.1 PARAMETER ESTIMATION

Sectors

The parameters have been estimated for the following ten sectors considered for application of the model.

1. Cereals
2. Pulses
3. Milk
4. Other Livestock (mostly producing meat and egg; includes fishery)

5. Sugar and gur
6. Edible oils (including vanaspati)
7. Textiles
8. General industry (all manufacturing except 5, 6 and 7; includes construction)
9. Other agriculture (sugarcane, oilseeds, cotton, vegetables, fruits etc.)
10. Services

Products of the first six sectors constitute the balanced diet basket. Fruits and vegetables are also normally counted in a balanced diet, but could not be considered here as a separate sector due to non-availability of input coefficients. Sectors 1 through 6 are referred to as the BN sectors. For the non-BN sectors, it was thought appropriate to keep a few broad groups to make the exercise manageable.

From the point of view of estimation, the parameters may be grouped into 3 categories.

A. External Estimates

Certain parameters are taken from the available literature. We have used Planning Commission's estimates of the parameters of the consumption and investment demand functions. The LES parameters have been estimated by a Task Force of the Planning Commission applying Newton Raphson method to time series of cross section data from several rounds of NSS consumption expenditure surveys (PPD, 1979). The estimates have been made for two income groups - those

below and above PL - in rural and urban areas. The investment function parameters have been estimated through regression using time series data from National Account Statistics (PPD, 1981). The nutrient coefficients are based on Gopalan et.al. (1978) as averaged for our commodity groups by Gupta (1987).

B. Econometric Estimates

Parameters in the wage equation and the log normal distribution have been econometrically estimated by us using stochastic specification. For wage equation, time series data on agricultural and industrial wages and corresponding consumer price index numbers are used. Due to data limitations estimates could be obtained for these two broad sectors only. Parameters for the various sectors coming under the two broad sectors are assumed to be the same. For fitting the log normal distribution, we use the NSS cross section data on size distribution of per capita expenditure for 1983. The following procedure is used to estimate the log normal parameters. Let $P(Y)$ be proportion of persons below per capita income Y . The lognormal distribution implies that

$$\begin{aligned} (6.1) \quad P(Y) &= \Phi(\log Y; \mu, \lambda) \\ &= \Phi\left(\frac{\log Y - \mu}{\lambda}; 0, 1\right) \end{aligned}$$

where $\Phi(\log Y; \mu, \lambda)$ is cumulative normal frequency of the variate $\log Y$ with mean μ and standard deviation λ . Taking inverse

of equation (6.1), we get

$$(6.2) \quad \frac{\text{Log } Y - \mu}{\lambda} = \phi^{-1} (P(Y))$$

Or, on rearrangement

$$(6.3) \quad \text{Log } Y = \mu + \lambda \phi^{-1} (P(Y))$$

The parameters are estimated by applying OLS to equation (6.3).

C. Point Estimates

All other parameters are point estimates from base year (1984-85) data. This category includes coefficients relating to inputs, labour, imports, stock changes, mark-up rates and tax rates. The point estimates have been made from an internally consistent structure of the Indian economy for 1984-85 constructed by making use of available data from different sources. The base year structure table given in the Appendix is an extended input-output table with value added disaggregated into wage income and profit (non-wage) income. Two general points regarding construction of the table may be mentioned here:

(1) All the required information at the necessary disaggregated level is not available for the base year. So, some old information is updated or certain assumptions are made regarding disaggregation (see Appendix for details).

(2) The data is often not consistent even when available from the same source. For example, National Accounts data on GDP from

income generation (factor payments) side does not equal that from expenditure side. This forced us to make several adjustments to the basic data to ensure consistency. In general our approach has been to take the available sectoral income or output figures as correct and adjust other figures like intermediates or those components of final demand for which detailed base year data is not directly available.

As this benchmark data is in current value terms, there is a need to choose the units to get nominal and real estimates. We follow the normal convention that units of all goods and labour are such that they have a price of unity in the base year. Block I dealing with adequate nutrients is an exception to this convention and prices per kilogram are used there.

Given the base year structure, several point estimates like input and labour coefficients may be obtained by straightforward division of one figure by the other. The mark-up rate (τ_i) is estimated using the following relation for base year:

$$(6.4) \quad \tau_i (\sum_j a_{ji} + l_i) X_i = \text{mark-up income}$$

when all $P_i = W_i = 1$.

Values of sectoral X_i and mark-up income are given in the structure table. Once a_{ji} 's and l_i 's are known, τ_i could be estimated from (6.4). Next, base year indirect tax rates (t_i) may be computed with the help of the price equation:

$$(6.5) \quad (\sum_j a_{ji} + l_i) (1 + \tau_i) (1 + t_i) = 1.$$

The intercept terms in the econometrically estimated functions are calibrated to get estimated values for the base year equal to the observed values. The investment functions are used without calibration because they involve future output growth rates and base year data are not sufficient for calibration. Given the calibrated parameters and the exogenous variables, the model can reproduce observed base year structure of the economy. Obviously, blocks I and II in the model, which are related to normative targets are not relevant for reproduction of base year results. Also, the base year values for PCE, percentage of poor and investment should be given for this purpose. The reproduction of the base year data set helps to start with the historically given levels of variables and the model is used to get solutions for future years that would represent change from the historical levels. The calibration procedure assumes that the benchmark position of the economy is one of equilibrium (Shoven and Whalley, 1984).

6.2 EMPIRICAL RESULTS

The model is operated to obtain empirical results for the terminal years of two plan periods: 1985-86 to 1989-90 and 1990-91 to 1999-2000. The first period coincides with the Seventh Five Year Plan. The two plan periods are often referred to as 0-5 years period and 5-15 years period and the corresponding terminal years as fifth and fifteenth years. Apart from use of the model for two future years, it is also used to derive results for base

year 1984-85. The base year results are of interest only for normative consumption pattern and associated price and tax implications; for other variables, operation of the model for base year produces the historical levels. The consumption norms estimated for base year are also used for fixing consumption targets for future years. The percentage of population meeting the norms differs over the years.

Consumption Norms

The first set of results given in Table 6.1 relates to the consumption norms or balanced diet baskets per capita per day for rural and urban areas. In working out the baskets several nutritional constraints are used taking ICMR (1981) and Sukhatme (1965) as guidelines (see Appendix). The rural basket meets about 300 calories more than the urban basket mainly because the proportion of people engaged in heavy work is larger in rural area (Perspective Planning Division, 1981). Consequently, solution of the rural basket contains more of foodgrains and sugar, the major sources of calories. The urban basket, on the other hand, contains more of milk, meat and oils, which are rich in animal protein and fat. This is due to two restrictions: (a) protein from animal origin is at least 15 per cent of total protein in rural area, whereas it is at least 20 per cent in urban area (the total protein constraint is the same at 45 gms. per capita per day in both areas); (b) consumption of edible oils is 5 grams more in urban area than in rural area. The consumption pattern in urban area is historically favourable to protein and fat rich

Table 6.1

Balanced Diet Basket and Required Unit Prices

	Balanced diet 'basket (kg. per 'day per capita)		Required base 'year prices 'corresponding 'to optimum 'consumption '(Rs. per kg.)		ICMR basket '(kg. per 'day per 'capita)
	Rural	Urban	Rural	Urban	All-India
1	2	3	4	5	6
1. Cereals	.526	.440	2.94	2.98	.436
2. Pulses	.027	.023	5.89	8.60	.036
3. Milk & products	.130	.142	1.61	3.84	.220
4. Meat, fish & egg	.010	.020	8.99	9.10	.015
5. Sugar and gur	.042	.026	2.54	7.59	.034
6. Edible oils	.015	.020	8.70	13.31	.037
7. Cost of the above basket (at required prices)	2.25	2.70			
8. Estimated poverty Line (per person per month for 1984-85)	91.68	150.34			
9. Cost of ICMR basket (at observed price 1984-85)	2.76	3.35			

food items as compared to the rural area. The two restrictions help in capturing this historical difference.

To facilitate comparison, the ICMR balanced diet basket used in Chapter 4 is reproduced in the last column of Table 6.1. The difference of our rural or urban basket from the ICMR basket is significant for several items. Three factors may explain the difference.

- i) Prevailing prices are used for solving the ICMR balanced diet basket, while we solve the baskets at prices required to meet the absorption problem.
- ii) ICMR recommendation refers to all-India level, whereas we have attempted to differentiate between rural and urban balanced diet.
- iii) ICMR recommended level for edible oil consumption (about 37 gms. per capita per day) is quite out of proportion compared to present availability (about 15 gms.). We fix the per capita norm of edible oil for rural area at 15 gms. per day, which is the minimum level recommended by Gopalan et.al. (1978). The corresponding norm for urban area is fixed at 20 gms. because of the historical difference mentioned above. The reduction in edible oil norm leads to an increase in cereal norm so that the basket as a whole provides the required calories.

Prices

Table 6.1 shows the unit prices in the base year that would have led to consumption of the balanced diet basket by person at PL in rural and urban areas. How different are these prices from the

observed prices? The answer appears in columns (2) and (4) in Table 6.2 in terms of price indices with the observed base year prices equal to unity. Had the normative consumption pattern been adopted by people at PL in the base year, the model solutions would have produced unit prices for all items. The solution prices shown in Table 6.2 are, however, very different from unity. The solution prices of cereals and pulses are higher than the observed prices. In particular, the model results show that cereal prices be raised by 32 per cent from the observed level. It indicates that cereal consumption in base year at PL is more than the norm. But in case of items like milk, meat and edible oils, the prevailing consumption levels are less than the norms and so the solution prices are lower than the observed prices by varying degrees ranging between 5 per cent (milk in urban area) and 48 per cent (edible oil in rural area). Directionwise these results reinforce the earlier results in Chapter 4 where the feedback of the prices to the consumption norms was absent.

Table 6.2 also presents the results relating to prices of fifth and fifteenth years. These are obtained on the assumption that cost of BN basket rises by 5 per cent per annum. As the normative basket is not altered, the relative prices of BN goods for fifth and fifteenth years are the same as in the base year. All the prices change by the same factor as the cost of BN basket so that quantities demanded do not change. The non-BN prices are not restricted by such condition and change by different extents for fifth and fifteenth years depending on sector specific cost conditions.

Table 6.2

Price and Tax Structure Required to Ensure Consumption of Balanced Diet

Sector	Base Year (1984-85)				Fifth Year (1989-90)				Fifteenth Year (1999-2000)			
	Rural		Urban		Rural		Urban		Rural		Urban	
	Price	Tax	Price	Tax	Price	Tax	Price	Tax	Price	Tax	Price	Tax
1. Cereals	1.323	.257	1.142	.108	1.688	.279	1.457	.129	2.750	.389	2.373	.236
2. Pulses	1.001	.060	1.231	.250	1.278	.093	1.571	.279	2.083	.196	2.559	.401
3. Milk	.575	-.414	.949	-.046	.734	-.398	1.212	.018	1.195	-.326	1.973	.105
4. Other animal husbandry	.680	-.305	.556	-.438	.868	-.285	.710	-.422	1.413	-.200	1.156	-.349
5. Sugar and gur	.603	-.303	1.357	.500	.769	-.288	1.732	.532	1.253	-.208	2.821	.710
6. Edible oils	.520	-.434	.770	-.191	.664	-.422	.982	-.173	1.081	-.356	1.600	-.074
7. Textiles	.964	.052	.986	.052	1.209	.052	1.235	.052	1.770	.052	1.797	.052
8. General industry	.961	.175	.994	.175	1.213	.175	1.253	.175	1.792	.175	1.840	.175
9. Other agriculture	.960	.012	.974	.012	1.185	.012	1.201	.012	1.700	.012	1.712	.012
10. Services	.972	.001	1.000	.001	1.227	.001	1.262	.001	1.810	.001	1.848	.001

Notes: 1. Prices are indices with observed 1984-85 value = 1.000.

2. Taxes are proportions of producers' prices.

3. Taxes in sectors 7 to 10 are exogenous.

Tax and Subsidies

The above structure of BN prices have tax and subsidy implications as shown in Table 6.2. For the base year, tax rate on cereals turns out to be about 25 per cent in rural area. Pulses in urban area also have similar tax implication. The non-grain food items in general need to be subsidised. Particularly, milk and edible oils in rural area and meat etc. in urban area show subsidy rates of more than 40 per cent of producers' prices.

The tax or subsidy rates continue to be large for fifth and fifteenth years too. It is interesting to note that the tax rates on cereals and pulses increase over the years, whereas the subsidy rates on other food items fall. The implication is that unit prime costs do not rise as fast as prices leading to higher taxes or lower subsidies over time. Recall that tax or subsidy on a BN good is residually determined from the cost based price equation in block III of Chapter 5.

We may note a few useful points about the results relating to prices and taxes. First, the price structure discussed above is designed to motivate consumers to consume the BN basket. The response of producers is not considered here. It is seen later in this chapter that incorporation of a positive relationship between mark-up and output would lead to revision of tax or subsidy rates.

Secondly, it is commonly believed that low prices of necessities like foodgrains help the poor consumers and some may find it counter-intuitive that our results suggest a rise in prices of

foodgrains and fall in prices of other BN food items. While only foodgrains are commonly regarded as necessities, we regard all items constituting the BN basket as necessities in this study. We attempt to meet the minimum targets in respect of all BN goods. We have seen earlier that people having adequate income to purchase BN basket consume more of foodgrains and less of other food items compared to the norms. Given this particular nature of the absorption problem observed in India, it is natural that the results would indicate rise in prices of foodgrains relative to those of other food items. The income-price solutions are, however, unique upto a scalar multiple (see, chapter 4). If some are worried about cereals price movement as such, one way out would be to keep cereals price fixed at some preassigned level such as the observed level in base year. A solution of this type would obviously indicate more drastic fall in prices of non-grain BN items from the observed levels. But, more importantly, the estimate of PL and percentage of people below PL would also be considerably reduced by such a construction. Indeed, by fixing price of one of the BN goods sufficiently low (high) it is possible to change percentage of people below PL to zero (hundred). Instead of keeping price of any of the BN goods fixed, we fix the cost of the BN basket at the same level as that at observed prices initially and revise it only to the extent the required prices change the composition of the balanced diet basket. In the process, the estimate of PL in our approach does not widely differ from the conventional level and we rely on both income increase and price changes for meeting basic needs of the deprived people.

Lastly, we had seen in chapter 2 that the per capita production of some BN items (e.g. edible oils) has declined or remained stagnant over the years. This could be one of the historical reasons for the substantial price change required for these items. Had their production grown on a positive trend like foodgrains, their relative prices would have been lower in the base year resulting in higher consumption than observed. This would have narrowed down the prevailing gap between the normative level and consumption at PL. In such an eventuality, the extent of required price changes would not have been as large as those shown in Table 6.2.

3 Scenarios

We may now turn to results relating to consumption, income and output. We study the behaviour of the model under several alternative scenarios and analyse effects of various policy packages. To begin with, we take up 3 scenarios for detailed examination. For each of the three scenarios the target on population below PL is fixed at 25 per cent in fifth year and 5 per cent in fifteenth year in both rural and urban areas^{1/}. The scenarios differ with respect to specification of Lorenz ratio (L) and post fifteenth year growth rate (R^{15}).

^{1/} In the base year 30.3 and 36.0 per cent of people lie below our PL in rural and urban areas respectively. The official plan exercise aims at reducing percentage of poor to 28.5 per cent by 1989-90 and 5 per cent by 1999-2000 at all-India level.

Scenario 1: (i) L kept at base year level (0.3030 for rural area and 0.2856 for urban area).

(ii) R^{15} same as growth rates during 5-15 years period ($F = 1.00$).

Scenario 2: (i) L reduced by 5 per cent for fifth year and by 15 per cent for fifteenth year.

(ii) R^{15} as in scenario 1.

Scenario 3: (i) L as in scenario 2.

(ii) R^{15} 30 per cent less than growth rates during 5-15 years ($F = 0.7$).

Private Consumption

Results relating to per capita total consumption expenditure (PCE) at constant price appears in Tables 6.3 and 6.4. Since the target on percentage of poor and the Lorenz ratio, the two determinants of consumption, do not differ between scenarios 2 and 3, the consumption implications remain invariant between these two scenarios. Some interesting points that come out from Tables 6.3 and 6.4 are the following:

- (a) Overall PCE growth required to meet a given basic need target is less with more egalitarian distribution. This is evident from a comparison of growth rates in scenario 1 with those in the other two scenarios.
- (b) The reduction in inequality affects adversely the non-poor group, but it helps the poor to improve their PCE levels. For the poor group, the positive effect of redistribution more than offsets the above negative effect associated with smaller overall PCE growth.

Table 6.3

Per Capita Consumption Expenditure(Rs. per month at 1984-85
prices)

Population Groups	'Base Year' '(1984-85)'	Scenario - 1		Scenarios 2 & 3	
		'1989-90'	'1999-2000'	'1989-90'	'1999-2000'
1	2	3	4	5	6
<u>Rural</u>					
1. Rural Poor	66.92	69.34	77.89	70.37	80.37
2. Rural Non-poor	174.49	207.88	331.19	198.23	272.87
3. All Rural	141.90	172.65	318.53	166.27	263.25
<u>Urban</u>					
4. Urban Poor	109.51	115.02	130.96	116.58	134.85
5. Urban Non-poor	261.80	297.90	472.49	286.59	395.30
6. All Urban	206.98	252.18	455.41	244.09	382.28
7. All India	157.87	193.92	362.66	187.08	301.63

Table 6.4

Growth Rates in Per Capita Expenditure

(Percentage per annum)

Population Groups	Scenario - 1			Scenarios - 2 and 3		
	0-5 yr.	5-15 yr.	0-15 yr.	0-5 yr.	5-15 yr.	0-15 yr.
1	2	3	4	5	6	7
<u>Rural</u>						
1. Rural Poor	0.71	1.17	1.02	1.01	1.34	1.23
2. Rural Non-poor	3.49	4.81	4.36	2.58	3.25	3.03
3. All Rural	4.00	6.32	5.54	3.22	4.70	4.21
<u>Urban</u>						
4. Urban Poor	0.99	1.31	1.20	1.26	1.47	1.40
5. Urban Non-poor	2.62	4.72	4.01	1.83	3.27	2.79
6. All Urban	4.03	6.09	5.40	3.35	4.59	4.18
7. All India	4.20	6.46	5.70	3.45	4.89	4.41

Notes: 0-5 yr. = During base year and 5th year.

5-15 yr. = During 5th year and 15th year.

0-15 yr. = During base year and 15th year.

(c) In any particular scenario PCE of the poor group increases at a lower rate than that of the non-poor group. The poor group consists of persons lying below the PL and as such the upper end point of the income range of this group is fixed at the PL, which explains the relative inflexibility in the mean consumption of the poor. It is useful to remember that some of the poor in the base year, who receive an income rise that lifts them above PL during the plan, are not counted as poor in the target year^{1/}. Indeed much of the benefit of the development process during the plan is reflected in the mobility of people from poor to the non-poor group and not by mean income changes of the poor group between base year and target year.

(d) PCE at all-India level grows at a rate higher than either rural or urban component. This is due to growing urbanization, which implies an increasing weight over time to the component with larger PCE level^{2/}. Similar argument also holds good within rural or urban area in Table 6.4.

^{1/} Of all the poor in the base year, some rise above PL in the target year while others are left behind to remain in poor category in the target year. It is possible that some of the non-poor in the base year climb down to become poor in the target year.

^{2/} Consider an example:

	PCE		Population	
	Rural	Urban	Rural	Urban
Period - 1	100	150	80	20
Period - 2	100	150	70	30

The all-India PCE is 110 in period-1 and 115 in period-2, which means growth at global level even when the components are stagnant. Growth is reflected by a larger proportion of people at a higher per capita income in this example.

Production Pattern

Real output and income growth rates corresponding to scenarios 1 to 3 are given in Table 6.5. The real output and income in a particular sector grow at the same rate in the model, but overall output and GDP grow at different rates because of sectoral weight differences. Irrespective of the scenarios, one main result from Table 6.5 is that the growth rates required to meet the normative consumption targets are high for sectors like milk, edible oils and meat-fish-egg (other livestock). The growth rates are the lowest in case of cereals and turn out to be negative during the first five years period. The rise in relative price of cereals in both rural and urban areas clearly depresses demand for cereals, which are substituted by other food items whose prices fall. The sectoral growth pattern implies a shift in production structure away from cereals and pulses to non-grain food sectors.

Comparison of the growth rates across scenarios yields some interesting results about working of the model. Between the first two scenarios, scenario 2 corresponds to more equitable distribution of consumption in both fifth and fifteenth years. Consequently, the required sectoral and overall growth rates in scenario 2 are lower than those in scenario 1 to achieve the same provision of minimum needs targets. For example, during 0-15 years period the required GDP growth rate is 7.3 per cent per annum without redistribution in scenario 1. The growth rate is reduced to 5.9 per cent in scenario 2 with moderate redistribution like reduction in Lorenz ratio by 1 per cent per annum.

Table 6.5

Output Growth Rates During Different Periods

(All figures are in percentage per annum)

Sector	Scenario - 1			Scenario - 2			Scenario - 3		
	0-5	5-15	0-15	0-5	5-15	0-15	0-5	5-15	0-15
1. Cereals	-0.40	3.44	2.15	-0.71	2.54	1.44	-0.74	2.46	1.38
2. Pulses	3.30	4.92	4.38	2.88	3.83	3.51	2.87	3.81	3.50
3. Milk	13.92	7.72	9.75	12.79	5.91	8.15	12.74	5.82	8.08
4. Other livestock (meat, fish & egg)	9.39	7.04	7.81	8.51	5.64	6.59	8.42	5.48	6.45
5. Sugar and gur	8.49	5.67	6.60	7.96	4.67	5.75	7.93	4.61	5.71
6. Edible oils	9.94	5.69	7.09	9.38	4.68	6.23	9.34	4.60	6.16
7. Textiles	5.99	9.84	8.54	4.74	8.07	6.94	4.65	7.95	6.84
8. General Industry	7.58	7.96	7.84	4.74	6.62	5.99	3.91	5.16	4.74
9. Other Agriculture	7.94	8.90	8.58	6.79	7.27	7.11	6.68	7.10	6.96
10. Services	6.29	7.85	7.33	5.00	6.64	6.09	4.73	6.21	5.71
Total output	6.88	7.78	7.48	5.13	6.42	5.99	4.72	5.72	5.38
GDP	6.50	7.76	7.33	5.04	6.39	5.94	4.73	5.88	5.49

0-5 : During Base year and 5th year

5-15: During 5th year and 15th year

0-15: During Base year and 15th year.

When the required GDP growth rate to achieve minimum needs targets turns out to be high enough to make the programme infeasible, one option as seen above is to reduce inequality. Another option is to sacrifice some future growth which would mean less present investment. This option is evident from a comparison of scenarios 2 and 3. A reduction in post-fifteenth year growth rates by 30 per cent leads to GDP growth rate decline of 0.3% and 0.5% during 0-5 and 5-15 years respectively (Table 6.5). Since the GDP fall in this case is due to depressed investment demand (See, Table 6.6 below), it is the general industry sector producing investment goods that suffers the most. The reduction in fifteenth year investment level brings down, in the first place, the growth rate during 5-15 years in Scenario 3 (compared to Scenario 2). The lower growth during 5-15 years reduces the investment demand for the fifth year, which, in turn, causes the growth rate during 0-5 years to fall. Thus, the post fifteenth year growth rate has an effect even on growth rate during 0-5 years, which shows the intertemporal binding nature of investment demand in a multi-period model.

Savings-Investment Implications

Table 6.6 provides the macro picture corresponding to the above 3 scenarios. The domestic savings rate shows an increase from the historical base year level under assumptions of scenario 1 alone. These assumptions call for a rather high capital formation rate of 31% of GDP, which may be difficult to realise. In scenario 3, on the other hand, the rate of capital

Table 6.6

Macro Variables for Scenarios 1, 2 & 3

(Rs.crores at 1984-85 prices)

Variables	'Base year'	Scenario - 1		Scenario - 2		Scenario - 3	
	'(1984-85)	'5th year	'15th year	'5th year	'15th year	'5th year	'15th year
1	2	3	4	5	6	7	8
1. GDP at factor cost	190888	261472	551876	244041	453577	240524	425794
2. GDP at market price	214373	295770	626577	274235	511511	269621	475087
3. Private consumption	140046	189071	415697	182403	345734	182403	345734
4. Public consumption	24062	30163	49132	30163	49132	30163	49132
5. Domestic savings=(2)-(3)-(4)	50265	76536	161748	61669	116645	57055	80221
6. Foreign savings = (imports-exports)	3582	14305	35709	11321	23115	10548	17006
7. Capital formation (fixed investment & stock changes)	53848	90841	197458	72991	139760	67603	97227
<u>% of GDP (at m.p.)</u>							
8. Private consumption	65.32	63.93	66.34	66.51	67.59	67.65	72.77
9. Public consumption	11.22	10.20	7.84	11.00	9.61	11.19	10.34
10. Domestic savings	23.45	25.88	25.81	22.49	22.80	21.16	16.89
11. Foreign savings	1.67	4.84	5.70	4.13	4.52	3.91	3.58
12. Capital formation	25.12	30.71	31.51	26.62	27.32	25.07	20.47

formation falls to unusually low level, particularly for 15th year. It seems to be within achievable limit in scenario 2 at about 27%. On this consideration, there is no need to resort to a drastic cut in post-fifteenth year investment level as assumed in scenario 3. An important implication to notice in Table 6.6 is that the rate of foreign savings is very high in scenarios 1 through 3 compared to base year. We carry out below some more experiments assuming inequality reduction as in scenario 2.

Import Substitution

The high level of foreign savings in the above scenarios is due to the fact that sectoral import-output ratios take the base year values. The absence of any import substitution programme contributes to large import bill. The next scenario aims at imports reduction.

Scenario 4: Import-output ratios are reduced by 10% for fifth year and by 20% for fifteenth year in addition to assumptions of scenario 2.

The results at macro level are presented in Table 6.7. The effects of import substitution may be seen from comparison of scenario 4 with scenario 2 (Table 6.6). Evidently, the effects are:

- (1) substitution of foreign savings by domestic savings; for example, in the fifteenth year, 16.5% of total savings is financed by foreign sources in scenario 2 (23115 out of 139760), the figure is reduced to 10.5% in scenario 4 (15290 out of 145065).

Table 6.7

Macro Variables for Scenarios 4, 5 & 6

(Rs. crores at 1984-85 prices)

Variables	Scenario - 4		Scenario - 5		Scenario - 6	
	'5th year	'15th year	'5th year	'15th year	'5th year	'15th year
1	2	3	4	5	6	7
1. GDP at f.c.	247155	464029	236666	474306	235432	464028
2. GDP at m.p.	278159	524641	267152	538099	265536	524640
3. Private consumption	182403	345734	168546	345734	168546	345734
4. Public consumption	30163	49132	30163	49132	30163	49132
5. Domestic savings	65593	129775	68443	143233	66827	129774
6. Foreign savings	9344	15290	8869	17095	8625	15290
7. Capital formation	74937	145065	77311	160327	75451	145063
<u>% of GDP (at m.p.)</u>						
8. Private consumption	65.58	65.90	63.09	64.25	63.47	65.90
9. Public consumption	10.84	9.36	11.29	9.13	11.36	9.36
10. Domestic savings	23.58	24.74	25.62	26.62	25.17	24.74
11. Foreign savings	3.36	2.91	3.32	3.18	3.25	2.91
12. Capital formation	26.94	27.65	28.92	29.80	28.41	27.65

- (2) expansion of domestic economy. The consumption targets in both the scenarios are fixed and so, less dependence on imports leads to more of domestic production in a demand determined system.

Less Ambitious Intermediate Targets

In scenarios 1 through 4 target on percentage of population below PL is fixed at 25% for 5th year and 5% for 15th year. The following scenario refers to a situation when the intermediate or 5th year target is less ambitious, but the long term or 15th year target remains unaltered.

Scenario 5: It postulates there will be 30% population below PL in both rural and urban areas in 5th year and (as earlier) 5% in 15th year. All other assumptions (including those regarding distribution) of scenario 4 are maintained here.

Effects of less ambitious intermediate target may now be studied through a comparison of results in scenario 5 with those in scenario 4 (See, Table 6.7). The main result is that the lesser is the 5th year consumption the higher is the GDP growth rate during the period 5-15 years to achieve a given target on incidence of poverty in 15th year.

There are two factors which explain the result. First, percentage of people to be lifted above PL reduces by 5% of total population during 0-5 years and increases by the same percentage during 5-15 years (in scenario 5 compared to scenario 4). Hence,

the private consumption level in 5th year is less, but the change during 5-15 years is correspondingly larger, because 15th year consumption level remains unchanged. Thus, a lower GDP growth rate during 0-5 years and a higher growth rate during 5-15 years is quite in order.

A second explanation for the above result runs through the intertemporal linkages in the model. Since the sectoral growth rates during 5-15 years are maintained during the post-15th year period, a higher growth rate during 5-15 years also means a higher investment demand in 15th year (See, row 7, Table 6.7). When output level in the intermediate (5th) year is subjected to fluctuations, the assumption regarding sustaining 5-15 years growth rates during post-fifteenth year may not always be desirable. In order to avoid the associated flip-flop, one may like to control 15th year investment level, which is attempted in the scenario below.

Scenario 6: This scenario is derived by modifying scenario 5 so as to keep 15th year capital formation at the same level as in Scenario 4.

The instrument to control 15th year investment is the factor 'F' (equation 5.25, chapter 5), which is varied over a few runs to get the controlled condition. A value of 0.924 for 'F' (as against 1.00 in Scenario 5) could produce scenario 6. It is interesting to find that, under the controlled capital formation condition, the 15th year results in scenario 6 are

reproduction of those in scenario 4. Thus, the differences in scenarios 4 and 5 for 15th year are entirely due to differences in capital formation level. In other words, if final target year investment level is controlled, the output levels in that year remain invariant to intermediate target change.

A Comparison with Planning Commission

Next, we compare the production structure estimated through our model with those projected by the official plan exercise (Planning Commission, 1986). The official projections are available only for 1989-90, the terminal year of the Seventh Plan. Table 6.8 gives a comparative picture of the Planning Commission figures and our results corresponding the above scenarios. The official exercise envisages that the sectoral composition of output in 1989-90 moves in favour of industry and service as compared to the base year. Correspondingly, the percentage contribution of all agricultural sectors (including animal husbandry) decline. Our results, on the other hand, do not show any general reduction in share of agricultural sectors. There is a shift in structure of production from cereals and pulses in favour of milk, other livestock, sugar and gur, and other agriculture. The share of industry increases in scenario 1 when size distribution of consumption remains unaltered, but it falls with reduction in inequality in scenarios 2 to 4. The consumption pattern at low income level is

Table 6.8

Changes in Sectoral Composition of Output

Sector	Composition 'in Base Year' '(1984-85) in' 'percentage	Composition in 1989-90 in terms of deviation from base year in percentage point						'Planning 'Commission
		SC-1	SC-2	SC-3	SC-4	SC-5	SC-6	
1	2	3	4	5	6	7	8	9
1. Cereals	7.19	-2.14	-1.79	-1.65	-1.86	-1.72	-1.68	-0.81
2. Pulses	1.13	-0.18	-0.12	-0.10	-0.13	-0.14	-0.13	-0.16
3. Milk	2.69	1.02	1.14	1.21	1.10	0.94	0.96	X
4. Other Livestock	1.96	0.24	0.34	0.37	0.31	0.27	0.28	X
5. Sugar and gur	1.98	0.16	0.26	0.33	0.26	0.19	0.21	0.04
6. Edible oils	2.10	0.32	0.46	0.51	0.45	0.41	0.42	-
7. Textiles	5.22	-0.21	-0.09	-0.01	-0.15	-0.45	-0.43	-0.31
8. General Industry	37.78	1.24	-0.70	-1.45	-0.25	0.81	0.56	1.98 ^{a/}
9. Other Agriculture	8.60	0.43	0.72	0.85	0.62	0.30	0.34	-1.52
10. Services	31.28	-0.86	-0.20	-0.02	-0.32	-0.59	-0.51	1.11

^{a/} Includes edible oils.

SC: Scenario.

Obviously more favourable towards agricultural products. The lower intermediate target in scenarios 5 and 6 causes industry output (investment) to go up for reasons discussed earlier. The differences in composition within the BN sector between our results and the Planning Commission's results may be attributed to the normative consumption targets in our case as against the behavioural targets of Planning Commission.

Effects of Increase in Mark-up Rates

The supply side response being conspicuously absent in the model structure, some insight can be gained by increasing the mark-up rates in those sectors where the required output growth rates are relatively high. Accordingly, we carry out a simulation run by increasing the mark-up rates of the non-grain food sectors by 25 per cent for rural area for 5th year. The only variable that gets affected by mark-up rate change is indirect tax rate. The results are the following:

Sector	Reference Run		Simulation Run	
	Mark-up rate	Tax rate	Mark-up rate	Tax rate
Milk	.7144	- .3977	.8930	- .4548
Other livestock	.4691	- .2851	.5864	- .3378
Sugar and gur	.1103	- .2882	.1379	- .3053
Edible oils	.0729	- .4223	.0911	- .4316

A rise in mark-up rates simply leads to an increase in subsidy rates of the relevant sectors. The mark-up rates play no role in determining BN prices in block II of the model. The

invariance of BN prices in turn means invariance of real variables like consumption and output.

The above result has an interesting policy implication. We have regarded earlier the tax or subsidy rate as the instrument to manipulate prices from consumers' point of view. The same instrument could now be used to permit right kind of incentives to producers as well. We can obtain the following relation from the price equation:

$$(1 + t_i) = k_i / (1 + \tau_i)$$

where $k_i = P_i / (\sum_j a_{ji} P_j + w_i l_i)$

Given consumers' prices (P_i) necessary to solve the absorption problem, an inverse relationship between mark-up and tax rate operates. If we now compute the 'right' kind of mark-up from supply response functions, the corresponding tax rates could be computed using the above relation. The tax or subsidy rates could provide the essential link between consumers' and producers' prices in a basic need plan.

Conclusion

In this chapter we have put to empirical use the model developed in the previous chapter. We have examined the implications of setting normative food consumption targets for almost all of the rural and urban population in India by the end of the century. The results obtained in several alternative scenarios

point towards a reorientation of structure of production and prices in India. There is a need to change consumption and production pattern away from foodgrains towards non-grain food sectors. It is also necessary to increase the price of foodgrains faced by consumers relative to other food items in both rural and urban areas so as to induce the consumers to adopt the normative consumption pattern.

Chapter 7

CONCLUSION

A primary objective of recent development strategy has been satisfaction of basic needs of life. The present study has attempted to solve some problems that arise in meeting this objective. The focus here has been on private consumption of a bundle of basic need goods (BNG) at some minimum levels. In conclusion, it is proper to make an overall appraisal of the issues examined and results obtained in the study.

7.1 SUMMARY

To start with, a BNG index is developed for evaluating the performance of an economy in producing basic needs such as food, clothing, health care and education. Two sets of weights - one based on ratio of budget share of middle income group to that of high income group, and another on inverse of income elasticity - have been proposed for aggregating the indices of per capita production of various basic needs. While GDP (per capita) continues to grow on a trend basis in India, the BNG index, with either set of weights, shows near stagnation since mid-sixties (chapter 2).

In the perspective of such a sluggish BNG sector, we turn to issues related to planning for provision of basic needs. The first exercise in any plan relates to fixing targets. Food consumption targets are determined on normative basis by considering requirement of various nutrients. Calorie is a major nutrient to determine the size of a food basket. There has been a controversy on the calorie level that a plan should target at, because of the adaptation

hypothesis put forth by Sukhatme. Examining this hypothesis, we find that, even if Sukhatme's propositions about adaptation are accepted, his conclusions need not be accepted on valid statistical grounds. Sukhatme's hypothesis has a built-in bias against an undernourished person, since it tends to maximise the error of exclusion of a person as undernourished when he is actually so. Moreover, there is no conclusive evidence on adaptation itself, specially without undesirable effects like reduction in body weight or work capacity. We also note the importance of nutrients other than calorie and advocate setting food consumption targets in terms of a balanced diet basket (chapter 3).

A poverty line is constructed as the income level just adequate to purchase a normatively defined consumption basket like the balanced diet one at prevailing prices. Plan targets are set for increasing income of the poor upto the poverty line. But provision of purchasing power by itself may not be sufficient to achieve the normative consumption targets of specific items. In fact the prevailing consumption pattern of people at or near the poverty line is very different from the normative pattern. The question that then arises is: how to ensure absorption of a normative consumption basket by the consumers? We explain the absorption problem in terms of inappropriateness of current relative prices and devise an income-price solution method to solve it by making use of the Linear Expenditure System (chapter 4).

Next, we extend the above solution method and develop a plan model suitable to analyse implications of meeting basic needs. The model has several special features:

- (a) the normative food consumption targets are determined through a cost minimising exercise satisfying nutritional constraints;
- (b) the income level and the BNG prices required to meet targets in (a) are estimated;
- (c) the non-BNG prices are determined by considering mark-up based prices;
- (d) a feedback mechanism from prices to the consumption norms operates;
- (e) the model shares with other Indian plan models specifications relating to sectoral consumption, output and investment estimation.

A model structure incorporating all these features is developed in an integrated and consistent manner (chapter 5).

Implementation of the model on Indian data (chapter 6) reveals several important results, which have not been obtained in earlier studies. First, development planning aiming at meeting a normative food basket in the context of India requires restructuring of prices. Absorption of the normative basket by the consumers would require substantial rise in consumers' prices of foodgrains relative to prices of other food items (milk, edible oils, meat etc.) with corresponding implications on indirect taxes and subsidies. Secondly, the basic needs strategy also points towards a different composition of national product; the structure of consumption and production moves away from foodgrains towards non-grain food sectors. Thirdly, the goal of meeting basic needs for all by the year 2000 A.D. calls for a

more egalitarian income/consumption distribution, unless GDP growth rate could be improved to over 7 per cent per annum. With moderate consumption redistribution (reduction in Lorenz ratio by 15 per cent by 2000 A.D.), GDP growth rate of about 6 per cent will suffice to achieve the basic need targets. A growth rate of this magnitude and the corresponding investment rate of 27 per cent is considered 'feasible' by the 8th Plan Approach Paper prepared recently by the Planning Commission.

7.2 APPRAISAL

The study centres around a premise that state action is necessary to steer consumers' and producers' choices towards some normatively desired direction. Often consumers are not 'efficient' optimisers with regard to nutrition, because of not only customs and traditions in food habit but also lack of information, which can be serious and widespread in an underdeveloped country. Hence, we deviate from the standard assumption that a consumer knows best what is good for him. The state in turn is assigned an active and paternalistic role in decision making. Our case is different from the classic case involving externalities, where the need for government interference is well accepted.

The state attempts to provide the minimum consumption levels of some items on normative considerations. Individual choice may differ from the normative levels, because an individual chooses his consumption bundle depending on his own subjective perception of his utility. This gives rise to the absorption problem. Our approach to solve this problem relies on selective price policy to influence consumer choice in the right direction - 'right' from the technocratic

angle. There are two other possible approaches to the problem. One is to educate the consumer to make him understand his own interest better. This would ultimately lead to change in taste and preference. While discussing a similar case, Musgrave and Musgrave note that state action in price front would supplement that in education front. "Given incomplete consumer information, temporarily imposed consumption choice may be desirable as part of a learning process, so as to permit more intelligent free choice thereafter" (1976, p. 65).

Another approach would be to make the basic need goods available to the people directly at the normatively stipulated levels. This would involve an elaborate rationing scheme and a country-wide network of government procurement and distribution of several goods. This approach involves quantity control in contrast to the price control approach followed by us. But, since free distribution of goods on such large scale as in a basic needs plan is not possible, even the rationing approach would involve some pricing policy as attempted in this study. A public distribution system may be viewed as a means of implementing the consumer subsidy scheme. Our approach presupposes that consumers have freedom of choice in the market in the sense that there is no quantity control on the amounts of purchases. The prices are controlled so as to induce the consumers towards a socially desirable consumption pattern.

The central theme of the study is the absorption problem and so the model developed here concentrates on the demand side. Supply is assumed to be perfectly elastic at the given mark-up rate. A simple way of extending the model to supply side behaviour will be to link the mark-up rate to output growth as follows:

$$\tau_i = \tau_i^O (X_i / X_i^*)^{\epsilon_i}$$

where

τ_i^O = Base mark-up rate

X_i^* = Output level on the basis of past trend for the terminal year of the Plan.

ϵ_i = An elasticity parameter of mark-up with respect to deviation of output from trend.

(τ_i & X_i as earlier for terminal year, For several alternative functional forms, see, Taylor, 1979, 1983).

This would reconcile the twin objectives of subsidizing food to consumers and providing adequate incentives to producers. The simulation on mark-up rate at the end of chapter 6 shows that the supply side extension would lead to revision of the tax or subsidy rates estimated in this study.

Another useful extension may be to 'close' the model through a feedback mechanism from structure of output to private consumption demand through income receipts of various classes. One way of closing the present model would be to endogenise the inequality parameter (Lorenz ratio) by considering distribution of sectoral value-added by income classes. It is commonly believed that change in composition of output towards meeting minimum needs would reduce inequality. In the absence of a value-added distribution matrix relevant for our sectoral classification, we could not verify this hypothesis. Some recent findings in other contexts, however, show little change in Lorenz ratio due to change in output structure [e.g. Sinha et.al (1979), Sarkar and Kadekodi (1988)]. If it turns out to be so for the basic need goods case also, it would mean possibilities of redistribution

at the point of production (income generation) are limited and instruments need to be devised for redistribution at the point of disposition of income by fiscal means.

The empirical exercises carried out in the study demonstrate the workability of the model to a range of issues and provide broad magnitudes of the numerical results. For any practical implementation, some simulations on the key parameters and alternative specifications of the main functional relations could provide useful insights. Our main results regarding the changes in price structure are obtained using a particular specification of the demand function. We believe a different specification will not alter the results very much, particularly the direction-wise movements of the required price changes. Such a 'belief' is based on comparison of the consumption norms with the observed consumption pattern of people near the poverty line.

Many developing countries now regard meeting basic needs of their people as a principal objective of economic development. Given this objective, there is an overwhelming need for developing a plan frame that incorporates a minimum need consumption basket and the associated policy instruments. This study is an attempt in the direction of fulfilling that need. As noted above, there are several areas that require further attention and the model could be considerably extended. With these extensions, it could help planners to design the basic needs strategy of development. By emphasising the need for restructuring prices and production, this study helps in focussing attention on some new issues in the area of development planning.

APPENDIX

PARAMETER VALUES WITH EXPLANATION

A CONSISTENT STRUCTURE OF INDIAN ECONOMY FOR 1984-85

The point estimates like input-output coefficients, labour coefficients, mark-up rates and indirect tax rates were obtained from a consistent structure of Indian economy prepared for 1984-85 and given in Table A.1 below. The basic data sources for construction of the table are:

- i) National Accounts Statistics (NAS), CSO (1987)
- ii) Seventh Plan Technical Note (7th TN), PPD (1986)
- iii) Sixth Plan Technical Note (6th TN), PPD (1981)
- iv) Economic Survey (ES), Ministry of Finance (1987).

Output and Income

The starting point for construction of a structure of an economy is collection of information on output and income for the selected sectors. The main source here is NAS, supplemented by 7th or 6th TN. Direct income and output estimates are available in NAS for a number of sectors, which are suitably aggregated for our purpose. But for some of our sectors, NAS provides only one of output and income levels. The missing figures in such cases are estimated making use of value-added output ratios available in 7th TN or 6th TN. For example, NAS reports value of output of various crops and livestock products at a fairly detailed level. But it gives value added figure only for whole of agriculture and

livestock. The value-added output ratios in 7th or 6th ^{1/}TN are employed to derive value-added levels of agricultural sectors. The total agricultural value-added thus obtained turned out to be 4 per cent less than the NAS level. The problem was solved by pro-rata adjustment in sectoral value-added figures subject to NAS total as control. Another problem was NAS does not have separate sectoral classification for edible oils and sugar-gur, which are included in 'food and beverage' industry. The necessary disaggregation within this industry group was made using 1979-80 structure from 6th TN.

Final Demand

NAS gives total of various types of final demand. It gives commodity-wise breakdown only for private consumption. Imports by major commodities are available in ES. Other final demand components - public consumption, stock changes and exports - were disaggregated into various sectors with the help of structures as in 6th and 7th TN. Fixed investment originates only from the 'general industry' sector and sectoral details were not necessary.

1/ The latest official input-output table is available in 7th TN for 1984-85 for 50 sectors. But some of our selected sectors like milk and edible oils do not appear as separate sectors. So, we had to rely on 6th TN. Also, information content in 7th TN is of limited nature. The input-output coefficients cannot even be aggregated, because output levels are not reported.

Wage and Mark-up Income

Five different categories of factor income are available in NAS: (a) compensation to employees; (b) interest; (c) rent; (d) profit and dividends; (e) mixed income of self-employed. We treat (a) as wage income and the rest as mark-up (non-wage) income. The NAS data relates to 14 sectors, but none of these correspond to our sectoral classification scheme. We compute the proportions of wage and non-wage income for 3 broad sectors - agriculture, industry and service. These proportions are applied for the sectors coming under each broad sector.

The mixed income category (e) contains both wage and profit components. Since we treat it as part of mark-up income, it leads to relatively high value of mark-up rates in the agricultural sectors, where large part of value-added falls in the mixed income category.

Indirect Tax

Sectoral tax rates are computed on the basis of the composition from 7th TN subject to total indirect taxes (net of subsidies) from NAS.

Intermediate Flows

We first obtain input-output coefficients for 1979-80 for our 10 sectors by aggregating intermediate flows for 89 sectors given in 6th TN (see, Dorfman, Samuelson and Solow, (1958) for aggregation procedure). Next; these coefficients were updated to

1984-85 considering the sectoral price movement between 1979-80 and 1984-85. Finally, flows for 1984-85 were obtained by considering the updated coefficients and the sectoral output levels.

Consistency

We have now gathered all the relevant data necessary for building the structure of Indian economy for 1984-85. The figures are from different sources and some are based on 1979-80 structure. Not surprisingly, they are not mutually consistent. At times, one comes across inconsistency in the statistics, even when they are from the same source. For example, NAS shows GDP at market price for 1984-85 as Rs.214385 crores considering factor income, indirect taxes and subsidies. But, the sum of all final demand expenditure, also a measure of GDP (at m.p.), is Rs.219660 crores. CSO (1987, p.99) shows Rs.5275 crores as a discrepancy, leaving it at that. In order to make the data consistent, we removed this discrepancy by adjusting private consumption, the biggest item among the final demand components.

In addition to aggregate GDP consistency, it is necessary to achieve equality between the row sum and column sum of each sector in the input-output table, since a consistent frame requires that each rupee of output produced in a sector must be used either for intermediate demand or final demand. The above data base showed differences between row and column sums that were at times as high as 10 per cent. As the output and income figures are on

relatively firm basis (atleast one of them is normally available in NAS), we used them as the controls in getting the consistency. The burden of adjustment mostly fell on the intermediate flows. The method followed was informal pro-rata adjustment similar to the formal RAS technique.

For the edible oils sector, the output level estimated earlier turned out to be only about half of private consumption level as given in NAS. This output level seemed low even after considering imports. Output estimation for edible oils was based on 1979-80 structure within the 'food and beverage' industry group. The structure has possibly changed considerably in the mean time. Hence, the earlier estimated output level for edible oils was revised. Sum of demand elements (row sum) was considered as the revised output.

Table A.1

Structure of Indian Economy 1984-85

Sector	Intermediate Demand									
	Cereals	Pulses	Milk & products	Other live-stock	Sugar and gur	Edible oils	Tex-tiles	General indus-tries	Other agri-culture	Services
	1	2	3	4	5	6	7	8	9	10
1. Cereals	2432	4	305	248	38	5	31	613		172
2. Pulses		326	117	69				21		32
3. Milk & products								866		151
4. Other livestock	929	178					179	814	563	208
5. Sugar and gur					125			286		114
6. Edible oils			35	20	275	360		541		9
7. Textiles	12	2	113	62	60	27	1980	1538	31	644
8. General industry	4928	193	161	126	612	839	3237	46966	1066	16718
9. Other agriculture	21	17	3164	3113	2917	3220	4612	3261	403	388
10. Services	719	102	984	869	1646	2432	3627	32172	558	23086
11. Gross value added(f.c)	20127	3741	5637	3141	1445	1109	5749	38647	30615	80677
a. Wage income	4480	833	1255	699	738	566	2935	19733	6815	43154
b. Profit income	15647	2908	4382	2442	707	543	2814	18914	23800	37523
12. Indirect taxes (Less subsidy)	-1050	63	22	30	637	223	1015	22010	406	141
13. Total (Output)	28118	4626	10538	7678	7755	8215	20430	147743	33642	122340

Contd..

Table A.1 (Contd....)

Sector	Final Demand						
	Private	Government	Gross	Changes	Exports	Imports	Total
	consump- tion	consump- tion	fixed investment	in stock			(Output)
	11	12	13	14	15	16	17
1. Cereals	23855	289		-133	501	242	28118
2. Pulses	4120	24		5	-	88	4626
3. Milk & products	9701	19		51	45	295	10538
4. Other livestock	4827	10		22	75	127	7678
5. Sugar and gur	7325	29		34	41	199	7755
6. Edible oils	7849	10		37	-	921	8215
7. Textiles	13576	132		1186	1225	158	20430
8. General industry	21135	4817	45828	6453	9447	14783	147743
9. Other agriculture	10458	144		361	1915	360	33642
10. Services	37206	18588		-	2708	2357	122340
11. Gross value added (f.c.)							190888
a. Wage income							81208
b. Profit income							109680
12. Indirect taxes (Less subsidy)							23497
13. Total (Output)	140052	24062	45828	8016	15957	19530	391085

Table A.2

Input-Output Coefficients

Sectors	1	2	3	4	5	6	7	8	9	10
1.	.08649	.00086	.02894	.03230	.00490	.00061	.00152	.00415		.00141
2.		.07047	.01110	.00899				.00014		.00026
3.								.00586		.00123
4.	.03304	.03848					.00876	.00551	.01674	.00170
5.					.01612			.00194		.00093
6.			.00332	.00260	.03546	.04382		.00361		.00007
7.	.00043	.00043	.01072	.00808	.00774	.00329	.09692	.01041	.00092	.00526
8.	.17526	.04172	.01528	.01641	.07892	.10213	.15844	.31789	.03169	.13665
9.	.00075	.00367	.30025	.40544	.37614	.39197	.22575	.02213	.01198	.00317
10.	.02557	.02205	.09338	.11318	.21225	.29604	.17753	.21776	.01659	.18870

Table A.3

Other Point Estimates

Sectors	Labour output ratio	Import output ratio	Value added output ratio	Mark-up Rate	Indirect tax rate
1	.1593	.0086	.7158	1.1574	- .0359
2	.1801	.0190	.8087	1.7569	.0416
3	.1191	.0280	.5349	.7144	.0021
4	.0910	.0165	.4091	.4691	.0040
5	.0952	.0257	.1863	.1103	.0895
6	.0689	.1121	.1352	.0729	.0278
7	.1437	.0077	.2814	.1695	.0523
8	.1336	.1001	.2616	.1770	.1750
9	.2026	.0107	.9100	2.5221	.0122
10	.3527	.0193	.6594	.4432	.0012

Note: A large part of agricultural income in India appears in the 'self-employed' category, which is treated as part of mark-up income. This explains the high mark-up rates and the low labour output ratios in agricultural sectors.

Table A.4

Marginal Propensity to Consume

Sectors	RURAL		URBAN	
	Below PL	Above PL	Below PL	Above PL
1	.4776	.0949	.2590	.0071
2	.0536	.0205	.0416	.0057
3	.0724	.0948	.1138	.0860
4	.0291	.0248	.0404	.0286
5	.0346	.0317	.0393	.0109
6	.0389	.0270	.0568	.0153
7	.0492	.1727	.0433	.1168
8	.0833	.2213	.0928	.1611
9	.0938	.0875	.1465	.2056
10	.0665	.2248	.1665	.3630

Source: PPD (1979) with regrouping for last 3 sectors.

Table A.5

Investment Function Parameters

<u>Sector</u>	<u>Replacement coefficient</u>	<u>Capital value added ratio</u>	<u>Lag period (years)</u>
Agriculture	.0339	3.6750	1
Industry	.0879	3.4840	3
Service	.0780	3.6348	2

Source: PPD (1981). It gives estimates for 14 sectors with most of the disaggregations confined to the service sector. We have used the estimates at the three broad sectoral level due to the differences in sectors classification. ICOR for industry is low because of inclusion of construction.

Table A.6

Wage Equation Parameters

<u>Sector</u>	<u>Coefficients of</u>	
	<u>CPI</u>	<u>Time</u>
Agriculture	.2885	.0295
Non-agriculture	.3485	.0339

Estimates have been made using OLS with first order correction for auto-correlation. Data sources are:

- (a) Jha and Mundle (1987) for agricultural wage
- (b) Annual Survey of Industry for industrial wage
- (c) Labour Bureau for Consumer Price Indices for agricultural and industrial labourers.

Table A.7

Nutrient Coefficients (Per kg.)

<u>Commodity</u>	<u>Calorie</u>	<u>Protein (gm.)</u>
Cereals	3380	96
Pulses	3490	233
Milk and products	830	38
Meat, fish and egg	150	180
Sugar and gur	3980	1
Edible oils	9000	-

Source: Gupta (1987)

Nutritional Constraints used for Balanced Diet Basket

- (a) Minimum per capita calorie intake of 2400 in rural area and 2100 in urban area. Minimum protein intake of 45 grams. Since fruits and vegetables are not included in the balanced diet basket because of data difficulty, the requirement levels are reduced by 100 calories and 4 grams of protein.
- (b) Contribution of cereals in total calorie be between 65% and 75%.
- (c) Ratio of cereals protein to pulse protein be between 6 and 8.
- (d) Protein from animal origin be at least 15% of total protein in rural area and 20% in urban area.
- (e) Calorie from sugar and gur be between 5% and 7% of total calories.
- (f) Intake of edible oils be 15 grams in rural area and 20 grams in urban area.
- (g) Minimum milk intake of 100 gms.

There are a number of vitamins and minerals which are required in tiny quantity, but nevertheless are very essential for proper functioning of the body. The proportion of animal protein to total protein is generally considered as a good indicator of the presence of these nutrients. Constraint (d) based on Sukhatme (1965) is developed for this purpose. Other constraints are developed considering ICMR (1981) recommendations for vegetarians and non-vegetarians. The minimum calorie levels for rural and urban areas are weighted averages of ICMR figures for various age-sex-activity groups, the weights being proportions of population of the groups (PPD, 1981). The 65 per cent lower limit on calorie from cereals in (b) is an additional constraint used by us and was necessary because of the price feedback mechanism.

- Adelman, Irma and S. Robinson (1978): "Income Distribution Policy in Developing Countries: A Case Study of Korea". Oxford University Press (for World Bank).
- Ahluwalia, Montek S. (1978): "Rural Poverty and Agricultural Performance in India", Journal of Development Studies, Vol. 14., No. 3.
- (1986): "Rural Poverty, Agricultural Production and Prices: A Re-examination", in Mellor and Desai (1986), op. cit.
 - (1990): "Policies for Poverty Alleviation", Asian Development Review, Vol. 8, No. 1.
- Anand, Sudhir (1977): "Aspects of Poverty in Malaysia", Review of Income and Wealth, Series 23, No. 1.
- Bardhan, P. K. (1973): "On Incidence of Poverty in Rural India", Economic and Political Weekly, Vol. VIII, annual No.
- Bhagwati, Jagdish (1988): "Poverty and Public Policy", World Development, Vol. 16, No. 5.
- Bhagwati, J. and S. Chakravarty (1969): "Contributions to Indian Economic Analysis: A Survey", American Economic Review, Supplement, Vol. 59, No. 4.
- Blitzer, C. R., P. B. Clark and L. Taylor (eds.) (1975): Economy Wide Models and Development Planning. London: Oxford University Press and World Bank.
- Brahmananda, P.R., and V.R. Panchamukhi (ed.) (1987): Development Process of Indian Economy. New Delhi: Himalayan Publishing House.

- Carter, A. and A. Brody (ed.) (1970): "Applications of Input-Output Analysis". Amsterdam: North Holland.
- Chakravarty, S. (1990): "Development Strategies for Growth with Equity: The South Asian Experience", Asian Development Review, Vol. 8, No. 1.
- Chakravarty, S., and L. Lefebvre (1965): "An Optimizing Planning Model". Economic Weekly, Vol. 17, Nos. 5-7.
- Chakravarty, S. and R.S. Eckaus (1964): "An Approach to Multi Sectoral Intertemporal Planning Model", in Rosenstein-Rodan (ed.) (1964) op.cit.
- Chakrabarti, S.K., and M.K. Panda (1981): "Measurement of Incidence of Under-nutrition", Economic and Political Weekly, Vol. XVI, No. 31.
- Chenery, H. B. (1955): "The Role of Industrialisation in Development Programmes", American Economic Review, Vol. 45, Part I.
- (ed.) (1971): Studies in Development Planning. Cambridge, MA: Harvard University Press.
- Dandekar, V. M. (1982): "On Measurement of Undernutrition", Economic and Political Weekly, Vol. XVII, No. 6.
- (1988): "Agriculture, Employment and Poverty", in Lucas and Papanek (1988) (ed.), op. cit.
- Dasgupta, R. (1983): "Estimation of Nutritional Intakes", Economic and Political Weekly, Vol. XVIII, No. 28.
- Dasgupta, P. and D. Ray (1985): "Adapting to Undernourishment: The Clinical Evidence and Implications", Economic Theory Discussion Paper No. 106, Department of Applied Economics, University of Cambridge.
- Deaton, A. S. (1975): "The Measurement of Income and Price Elasticities", European Economic Review, Vol. 6.

- Dorfman, R., P. A. Samuelson, and R. Solow (1958): Linear Programming and Economic Analysis. New York: McGraw Hill Book Company.
- Drewnowski, J. and W. Scott (1966): The Level of Living Index. Geneva: United Nations Research Institute for Social Development, Report No. 4.
- Dutta, Bhaskar (1980): "Intersectional Disparities and Income Distribution in India: 1960-61 to 1973-74", Indian Economic Review, Vol. XV, No. 2.
- Eckaus, Richard S. and Kirit S. Parikh (1968), Planning for Growth: Multisectoral Intertemporal Models Applied to India. Cambridge, MT: MIT Press.
- Frisch, R. (1960): Planning for India : Selected Explorations in Methodology. Bombay, Asia Publishing House.
- Ghai, D. P., A. R. Khan, E. L. H. Lee and T. Alfthan (1977): The Basic Needs Approach to Development: Some issues Regarding Concepts and Methodology. Geneva: International Labour Organisation.
- Ghosh, A. (1964): "Experiments with Input-Output Models: An Application to the Economy of the United Kingdom, 1948-55". Cambridge University Press.
- Gopalan, C., B. V. R. Shastri, and S. C. Balasubramaniam (1978): Nutritive Value of Indian Foods. Hyderabad: National Institute of Nutrition (ICMR).
- Gopalan, C. (1983): "Measurement of Udernutrition: Biological Considerations", Economic and Political Weekly, Vol. XVIII, No. 15.
- Gupta, Saroj (1987): "Interstate Variations in Food Consumption, Nutritional Adequacy and Levels of Poverty". New Delhi: USAID, Occasional Paper No.4.

- Gupta, S. P. (1989): Planning and Development in India, New Delhi, Allied Publishers Private Limited.
- Gupta, S. P. and T. G. Srinivasan (1984): "Inflation and Role of Administered Prices", Economic and Political Weekly, Vol. 19, No. 36.
- Hicks, N. and P. Streeten (1979): "Indicators of Development: The Search for a Basic Needs Yardstick", World Development, Vol. 7, No. 6.
- Indian Council of Medical Research (ICMR) (1981): Recommended Dietary Intakes for Indians. New Delhi: ICMR.
- Jha, Sikha and Sudipto Mundle (1987): "Inflationary Implications of Resource Mobilisation Through Administered Price Increases", Economic and Political Weekly, Vol. XXII, No. 33.
- Johansen, L. (1960) : A Multi-sector Study of Economic Growth. Amsterdam, North Holland .
- Joseph Pushpam (1968): "An Application of the Linear Expenditure System to the Indian Data", Economic and Political Weekly, Vol.3, No.15
- Khan, A. R. (1977): "Basic Needs Targets: An Illustrative Exercise in Identification and Quantification", In Ghai et. al. (1977).
- Kuznets, Simon (1955): "Economic Growth and Income Inequality", American Economic Review, Vol. 45, No. 1.
- Lee, E. L. H. (1977): "Some Normative Aspects of Basic Needs Strategy", in Ghai et. al. (1977).
- Lucas, Robert E. B. and G. F. Papanek (1988): "The Indian Economy: Recent Developments and Future Prospects". New Delhi, Oxford University Press.

- Mahalanobis P.C. (1953): "Some Observations on the Process of Growth in National Income", Sankhya, Vol.12, Part 4.
- (1961): Talks on Planning. Calcutta: Statistical Publishing Society.
- Manne, A. S. and A. Rudra (1965): "A Consistency Model of India's Fourth Five Year Plan", Sankhya, Series 'B', Vol. 27.
- Mellor, J. W. and G. M. Desai (eds.) (1986): Agricultural Change and Rural Poverty in India: Variations on a Theme by Dharm Narayan, Delhi: Oxford University Press (for IFPRI).
- Minhas B.S., L.R. Jain, S.M. Kansal and M.R. Saluja (1987): "On the Choice of Appropriate Consumer Price Indices and Data Sets for Estimating the Incidence of Poverty in India", Indian Economic Review, Vol.22, No.1
- Murty, G. V. S. N. and K. N. Murty (1977): "On Differential Effects of Price Movements", Indian Economic Review, vol. XII, No. 2.
- Narayana N. S. S., K. Parikh and T. N. Srinivasan (1987): "Indian Agricultural Policy: An Applied General Equilibrium Model", Journal of Policy Modeling, Vol. 9, No. 4.
- (1988) : "Rural Works Programs in India : Costs and Benefits", Journal of Development Economics, Vol. 29, No. 2.
- Nordhaus, W. and J. Tobin (1971): Is Growth Obsolete?, Cowles Foundation Discussion Paper No. 319.
- Panda, M. K. (1986): "Fixing Income and Price Targets for the Poor in India", Journal of Development Economics, Vol. 20, No. 2.

Panda, M. K. and S. K. Chakrabarti (1981): "Economic Growth in India - Comparison of GNP and BNG (Basic Need Goods) Index Numbers", Indian Economic Review, Vol. 27, Nos: 2-4.

Panda, M. K. and K. C. Majumdar (1983): "Intertemporal Consistency and Sixth Plan Model of India". Calcutta: Indian Statistical Institute (mimeo).

Panda M.K. and H. Sarkar (1990): "Resource Mobilisation Through Administered Prices in an Indian CGE", in Taylor (ed.) (1990) op. cit.

Paul Pushpam and Ashok Rudra (1964): "Demand Elasticities for Foodgrains", Economic Weekly, Vol.16, No.48.

Perspective Planning Division (1962) : " Perspectives of Development: 1961-1976, Implications of Planning for Minimum Level of Living". New Delhi: Planning Commission. Reprinted in Srinivasan and Bardhan (1974) op. cit.

- (1973): A Technical Note on Approach to the Fifth Five Year Plan of India. New Delhi: Planning Commission.
- (1979): Report of the Task Force on Projection of Minimum Needs and Effective Consumption Demand. New Delhi: Planning Commission.
- (1981): A Technical Note on the Sixth Five Year Plan of India. New Delhi: Planning Commission.
- (1986): A Technical Note on the Seventh Five Year Plan of India. New Delhi: Planning Commission.

Planning Commission (1952): "First Five Year Plan". New Delhi: Government of India.

- (1973): "Draft Fifth Five Year Plan 1974-79", Government of India.

- (1978): "Draft Five Year Plan 1978-83", Government of India.
- (1981): "Sixth Five Year Plan 1980-85", Government of India.
- (1990): "Approach To The Eighth Five Year Plan 1990-95", Government of India.

Radhakrishna, R., G. V. S. N. Murty and N. C. Shah (1979): Models of Consumer Behaviour for Indian Economy. Ahmedabad: Sardar Patel Institute of Economic and Social Research.

Rand, W. M. Scrimshaw and V. Young (1985): "Restrospective Analysis of Data from Five Longterm Metabolic Balance Studies", American Journal of Clinical Nutrition, Vol. 42.

Reutlinger, S. and M. Selowsky (1976): Malnutrition and Poverty: Magnitudes and Policy Options. Baltimore: John Hopkins Press, World Bank Staff Occasional Paper No. 23.

Rosenstein-Rodan P.N. (1964): Capital Formation and Economic Development. London: George Allen & Unwin Ltd.

Rudra, Ashok (1966): "Decentralised Long-term Planning - A Frame", Indian Economic Review, Vol. I (New Series), No. 1.

- (1967), Relative Rates of Growth: Agriculture and Industry. University of Bombay, Series in Economics No. 14.
- (1969), Measurement in Economics. Bombay: Allied Publishers.
- (1974): "Minimum Level Of Living - A Statistical Examination", in Srinivasan and Bardhan (ed.) (1974) op. cit.

- (1975): Indian Plan models. New Delhi: Allied Publishers Private Limited.
 - (1978): The Basic Needs Concept and Its Application to Indian Development Planning. Bangkok: International Labour Office (ILO-ARTEP).
- Sandee, J. (1960): A Demonstration Planning Model for India. Bombay, Asia Publishing Company.
- Sarkar H. and S. V. Subbarao (1981): "A Short Term Macro Forecasting Model for India: Structure and Uses", Indian Economic Review, Vol. 16, No. 1-2.
- Sarkar, H. and G. Kadekodi (1988): Energy Pricing in India: Perspectives, Issues and Options. New Delhi: International Labour Office (ARTEP).
- Sen, A. K. (1976): "Poverty: An Ordinal Approach to Measurement", Econometrica, Vol. 44, No. 2.
- Shoven, John B. and John Walley (1984) : "Applied General Equilibrium Models of Taxation and International Trade", Journal of Economic Literature, Vol. 22, No. 3.
- Sinha, R., Peter Pearson, Gopal Kadekodi and Mary Gragory (1979): Income Distribution, Growth and Basic Needs in India. New Delhi: Vikas Publishing House.
- Stone, J. R. N. (1954): "Linear Application System and Demand Analysis: An Application to the pattern of British Demand", Economic Journal, Vol. 68.
- Srinivasan T. N. (1965): "Critique of the Optimising Planning Model", Economic Weekly, Vol.17, Nos. 5-7.
- (1986): "Agricultural Production, Relative Prices, Entitlements and Poverty", in Mellor and Desai (ed.) (1987) op. cit.

Srinivasan, T. N. and P. K. Bardhan (eds.) (1974): Poverty and Income Distribution in India. Calcutta: Statistical Publishing Society.

Srinivasan, T.N., M.R. Saluja and V.C. Sabherwal (1965): "Structure of Indian Economy: 1975-76". New Delhi: Indian Statistical Institute, Discussion Paper No. 4.

Streeten, Paul (1981): First Things First: Meeting Basic Human Needs in Developing Countries. New York: Oxford University Press and World Bank.

Streeten, Paul, and J. Burki (1978): "Basic Needs: Some Issues", World Development, Vol. 6, No. 3.

Sukhatme, P. V. (1965): Feeding India's Growing Millions. Bombay: Asia Publishing House.

- (1974): "The Protein Problem: Its Size and Nature", Journal of Royal Statistical Society, Series 'A', Vol. 137.
- (1977): "Discussion on Problems in the Measurement of Poverty", Bulletin of the International Statistical Institute, Vol. XLVII, Book-1.
- (1978): "Assessment of Adequacy of Diets at Different Income Levels", Economic and Political Weekly, Vol. 13, Special No.
- (ed.) (1982): Newer Concepts in Nutrition and their Implications for Policy. Pune: Maharashtra Association for Cultivation of Science.

Sukhatme, P. V. and S. Margen (1978): "Models of Protein Deficiency", American Journal of Clinical Nutrition, Vol. 31, No. 7.

Taylor Lance (1975): "Theoretical Foundations and Technical Implications", in Blitzer et.al. (1975) op. cit.

- (1979): Macro Models for Developing Countries. New York: McGraw Hill.
- (1983): Structuralist Macroeconomics. New York: Basic Books.
- (ed.) (1990): Socially Relevant Policy Analysis: Structuralist Computable General Equilibrium Models for the Third World. Cambridge, Massachusetts : MIT press.

Tendulkar, Suresh D. (1971) : "Interaction Between Domestic and Foreign Resources in Economic Growth: Some Experiments for India", in Chenery (ed.), (1971), op. cit.

- (1974): "Planning Models for Growth and Distribution in India: An Assessment", in Srinivasan Bardhan (ed.) (1974), op. cit.
- (1987) : "Economic Inequality and Poverty in India: An Interpretative Overview", in Brahmananda and Panchamukhi (ed.) (1987), op. cit.

Watanabe, T. and S. Shishido (1970): "Planning Applications of the Leontief Model in Japan", in Carter and Brody (ed.), (1970), op. cit.

Weisskopf, Thomas E. (1967) : "A Programming Model for Import Substitution in India", Sankhya, Vol.29, Series B.

- (1971) : "Alternate Patterns of Import Substitution in India", in Chenery (ed.) (1971), op. cit.