WORLD EMPLOYMENT PROGRAMME RESEARCH

Working Papers

International Labour Office, Geneva

WEP 2-32/WP 25

WORLD EMPLOYMENT PROGRAMME RESEARCH

Working Paper

ECONOMIC AND SOCIAL POLICY

SYNTHESIS PROGRAMME

INDIA - BASIC NEEDS: A Socio-Economic and Demographic Simulation Model

by

J.G. Krishnayya, K.N.S. Nair
B. Joshi, V. Phaneendhrudu
S. Chatterji
Systems Research Institute
Poona

March 1981

ISBN 92-2-102729-5

The designations of countries employed [which are in conformity with United Nations practice], and the presentation of the material in this paper do not imply the expression of any opinion whatsoever on the part of the International Labour Office concerning the legal status of any country or territory or of its authorities, or concerning the delimitations of its frontiers.

The responsibility for opinion expressed in WEP Research Working Papers rests solely with their authors, and their circulation does not in any way constitute an endorsement by the International Labour Office of the opinions expressed in them.

PREFACE

The present working paper is the first one of a series of papers produced by the ILO as background material for the preparation of the International Development Strategy for the Third Development Decade. The aim of such papers is to contribute to a better understanding of the relation between basic needs and economic development, as well as between international trade and domestic issues.

The case study of India, carried out by the Systems Research Institute in Poona under the supervision of Mike Hopkins and Rolph Van Der Hoeven, uses a dynamic simulation model, consisting of a socio-demographic block, an economic block and a basic needs block to capture the main trends in Indian development until the year 2000. It also investigates the consequences on the economy and the satisfaction of basic needs of four different scenarios, namely on the one hand an increase or a decrease in international economic relations and, on the other hand, an export oriented or a human resources based scenario.

We thought it would be useful to bring this original and pioneering work to the attention of research workers in this field, and would welcome comments.

20.3.81

Jean Mouly

INDIA BASIC NEEDS

Contents

This report is presented with the intention of stimulating discussion on the application of large scale computer simulation models for policy analysis in developing countries. Such analysis is very common in the West (for planning and policy making both in the government and private sector) with respect to investment, tax issues, employment, education, trade, etc.

The necessity of such analysis by, in and for developing countries is felt not only because of the complexity of the system but also because of the rapid changes taking place in the socio-economic sphere -- national as well as international. For example very few developing countries can comfortably absorb the external shocks to which they are constantly being subjected due to various changes in the international economic scene such as oil prices. Countries can no longer adopt any single simple strategy for planning. They require effective tools to study and evaluate their options under various assumptions on a continuing basis as changes take place in the international economic scene. In fact even different regions/states within a country need such models for effective exploitation of the degrees of freedom available to them on health, education, employment and settlement-size policies within the overall planning framework of the country.

However, such state-level comprehensive models cannot be built today for the reason that the teams of modellers (a team size of three or four is required) do not exist, even if the funds were made available. Therefore, an important task of existing modelling groups, including SRI's, must be to develop means of giving the experience to econometricians, demographers, sociologists, statisticians, economists and others which would enable them later to undertake such efforts.

From world-wide experience it can be said that model-building is a craft into which apprenticeship is the best entry. This means that State Planning departments must send their economists and planning officials to work with modelling groups, and that modelling groups should work closely with the Planning Boards and Departments to define the potential uses of the models they build.

March 1981

J G Krishnayya

ACKNOWLEDGEMENTS

We would like to place on record the debt we owe to the Economic and Social Policy Synthesis Branch of the Employment and Development Department at ILO for their assistance, their faith in us and their unfailing enthusiasm for spreading the use of modelling into LDC institutions. Rolf van der Hoeven's and Michael Hopkins' interest and encouragement were essential in getting this project off the ground. We are happy also to acknowledge the cooperation extended by Mr N Bouchouchi, Mr R Iyer and Mr Solomon of UNESCO's Division of Socio-Economic Analysis, with whose help we held an International Workshop on Applications of Modelling in LDCs in 1980. We would like also to record our appreciation for the work of Prof R Scott Moreland whose "Bachue International" was used as the basis for our model.

The encouragement of Dr A Ramachandran, Dr S C Seth and Dr B D Tilak of the Department of Science & Technology, and of Dr Nitin Desai at the Planning Commission has also been important in getting us started and in keeping this group in existence. Many others in the modelling fraternity have sent us material, kept us informed of work and answered questions. We can only repay them by ourselves helping others to get involved in this challenging field of work.

. . .

About the Authors .....

Prof J G KRISHNAYYA is Director of SRI and has been responsible for SRI's interest in Futures Analysis. He is a Member of the Futurology Panel of the National Committee on Science and Technology.

Dr K N S NAIR is an economist and econometrician with interests in econometric modelling, demand analysis and forecasting. He was responsible for the estimation of the model and for much of the write up.

Dr B JOSHI is an economist with a strong interest in Futures. He developed much of the data base used in the estimation and was largely responsible for work on the model earlier.

Dr V PHANEENDHRUDU is a demographer/statistician with interests in computers and modelling. He took responsibility for constructing the demographic aspects of the model, and has been deeply involved in the estimation.

Dr S CHATTERJI is a mathematician with interests in data analysis and computing. He was responsible for the programming of the model.

CHAPTER 1

THE APPROACH TO BASIC NEEDS IN INDIAN PLANNING

1.1 Introduction

The global concern on Basic Needs is of recent origin and has been accounted elsewhere.[1] Among the developing countries, India has taken lead in formulating development plans with a focus on problems of satisfaction of Basic Needs. However, the purpose and strategy of Basic Needs as recognised by the ILO Economic and Social Policy Synthesis Programme, significantly differs from that adopted by Indian planners. Chapter I aims, therefore, to give a brief account of the approach of Indian planners to Basic Needs.

1.2 Historical Setting

Having obtained political independence in 1947 from colonial rule, India chose a democratic way to build a socialistic pattern of society. The concern for the provision of national minimum level is stated in the directive principles of the Indian Constitution; namely,

1) Adequate livelihood and living wages
2) Employment or work
3) Education facilities to be available to all but compulsory for children upto the age of 14 years
4) Public assistance in case of want, old age, sickness and unemployment
5) Full enjoyment of recreational, social and cultural facilities
6) Adequate nutrition and improved health.[2]

1.3 Evolution of Concepts over Different Plans

Indian Planning derives direction and strength from the Constitution of India. The first and second Five Year Plans, while emphasising the need for raising the standard of living through economic growth did not, however, refer to a minimum standard of living. The economic policies

---

1. See select bibliography at the end of the report
2. Government of India, Ministry of Law, The Constitution of India, Act 41, 43, 45, 46, 47, Part IV.

of these plans were based on the mixed economy model where the living wages were left essentially to market forces. Social policy consisted of social services and social welfare services. The former included (1) educational facilities (2) medical facilities (3) transport and communication facilities (4) housing facilities. The social welfare services dealt with needs of special groups regarded as vulnerable, such as, women and children, and backward classes. These plans, therefore, reflect a dual characteristic. One, increasing the purchasing power in the hands of the poor through certain investment practices were directed at rapid growth of output in agriculture and industry. Two, expenditure in social services and welfare.[3]

1.3.2. A more well defined approach called 'Minimum levels of Living' or the 'Minimum Needs' approach came about in the early sixties. The Perspective Planning Division (PPD) document emphasized the concept of absolute poverty and a minimum income level. This was in direct contrast to the implicit assumptions in the First and Second Plans of relative levels of poverty. At the same time the PPD document was aware of limitations of the approach by stating "redistribution on this scale is operationally meaningless, unless revolutionary changes in property right and the structure of wages and compensations are contemplated.[4]

The Third Plan, while spelling out the constituent elements of a national minimum for standard of living did not, however, lay down any norms to be achieved. The constituents of a national minimum were (1) food (2) work (3) educational opportunity (4) health and sanitation facilities (5) housing (6) a minimum level of income (this in the BN parlance may be called basic needs income).

The Fourth Plan laid its emphasis on 'weaker sections' of society. It still did not have any integrated plan for providing for basic minimum needs. While it introduced a number of specific programmes, such as,

---

3. Rudra, A., 'The Basic Needs Concept and its Implementation in Indian Development Planning Asian Regional Programme for Employment Promotion, ILO, Bangkok, 1979.

4. 'Perspectives of Development: 1961-1976, implication of planning for a minimum level of living in Poverty and Income Distribution in India', T N Srinivasan and P K Bardhan (ed), ISI, Calcutta.

Small Farmers Development Agency, and Rural Construction Works Programme, it argued against public welfare activities, which it claimed had to be relatively speaking reduced to a minimum.[5]

It is in the Draft of the Fifth Plan that the theme of elimination of poverty and the achievement of a minimum level as its central goals appeared. A fresh strategy for the removal of poverty was adopted. It was maintained that if "one has to rely on growth alone without directly tackling the problem of unemployment and income distribution it may take another thirty years or fifty years for the poorest sections of the people to reach a minimum consumption level".[6] With a larger availability of resources, it was believed that it was possible to directly tackle the problem of unemployment, and poverty, and simultaneously ensure economic growth. That is, the controversy between production and distribution was no more thought to be valid. The basic framework and parameters of the Fifth Plan were based on the PPD model.

The National Minimum Needs Program

The rationale behind the national program for Minimum Needs was that, even if vast employment opportunities were created, it would not be possible with the lowest levels of earning to procure all the essential goods and services.

The national minimum needs program spelled out the objectives of the target group more specifically, namely,

1. The provision of facilities for elementary education for children upto the age of 14 years at nearest possible places to their home.
2. Ensuring in all areas a minimum uniform availability of public health facilities which would include preventive medicines, nutrition, and adequate arrangements for referring serious cases.
3. Supply of drinking water to villages suffering from chronic scarcity or having unsafe sources of water.

---

5. Government of India, Fourth Five Year Plan, Planning Commission 1969, p.19.
6. Government of India, 28th Meeting of the National Development Council, May 30 and 31, 1972, Summary Record, Planning Commission, New Delhi, p.1.

4. Provision of all weather roads to all villages having a population of 1500 persons or more.
5. Provisions of developed home sites for landless labour in rural areas (100 sq.ft. per family).
6. Environmental improvement of slums.
7. Spread of electrification to cover 30% to 40% of the rural population.[7]

In the Fifth Plan these objectives take clearer dimensions with norms for all of them clearly spelled out. Implicit in the assumptions of the national minimum needs program is (i) binding the most essential social services into a whole would be more viable than treating them separately, (ii) the physical convergence of facilities at growth centres would lead to a reversal of the trend of 'over-urbanisation' (iii) the levels of income that would remain low despite increases in the overall rate of growth, would have to be supplemented.[8]

The Revised Minimum Needs Programme of the Draft Sixth Plan* differs with the fifth plan Minimum Needs Programme only in terms of norms; the nine items of basic needs are same, namely, (1) elementary education, (2) adult education, (3) rural health, (4) rural water supply, (5) rural roads, (6) rural electrification, (7) houses for landless rural labour households, (8) environmental improvement of urban slums, and (9) Nutrition programme.

It is interesting to note that in both Fifth as well as Draft Sixth Plan there does not appear any mention of priority among the basic needs. Thus, education appears at the top and nutrition at the bottom. It is, therefore, assumed that they are not prioritised in that order. Rudra, for instance, questions rural electrification inclusion in the minimum needs programme on the grounds that it is accessible generally to the well-off non-target rural population.

---

7. Government of India, National Development Council, (op cit) p.5-9.
8. Baji, C., 'The Minimum Needs Programme. A Study on Social Development Policy, Centre for Policy Research, New Delhi, 1975.

* What was called Draft Five Year Plan 1978-83 and is now superceded by the V Year Plan '80-'85.

The Minimum Needs Programme is said to have some conceptual drawbacks as well. Rudra, elaborating upon these, points out that it has treated the minimum private consumption part of the strategy too much in terms of expenditure (i.e. the information relevant get lost in aggregation) while too little attention is given to individual essential commodities in qualitative and quantitative terms.[9]

It is further pointed out that the mechanisms through which the basket of consumer goods would reach the target group has not been stated. No efforts were either made to quantify the direct or indirect employment and income effects of such schemes for the weaker section. An equally serious defect in the Minimum Needs Programme has been not setting up a time horizon for fulfillment of minimum target of private or public consumption.[10]

The new Sixth Plan recognises the need for supplementing the minimum needs programme by wider programmes in other social service sectors and hence calls for the adoption of a systems approach.[11]

1.4 Empirical Evidence on Basic Needs Satisfaction

The under achievement of Indian Plan targets, for whatsoever reasons, is a known fact.[12] Plans and programmes for the income re-distribution, unemployment, and minimum needs programmes in favour of the poor and weaker sections of the society are no exception to the rule. Besides its modest achievement of targets, Indian Planning has miserably failed in poverty reduction.

The fiscal measures adopted for income redistribution have been found to be fairly progressive. Both direct taxation and incidence of indirect taxation in India have largely been one of the most progressive in the world.[13]

---

9. Rudra, A., (op cit) p.17
10. Ibid, p. 19-20
11. Government of India, Planning Commission Sixth Five Year Plan 1980-85. A Framework, p.40.
12. Bhagwati, J., and Desai, P., 'India Planning for Industrialization'.
13. Lakdawala, D T., 'Redistributive Policies and Basic Needs in Indian Planning', Seminar on 'The Basic Needs Approach to Indian Planning, 21-22 July, Trivandrum, 1980.

Social services are said to have the most redistributive effect. However, despite the fact that total plan and non-plan expenditure on education had grown fivefold between 1965-66 and 1977-78, it has shown little immediate effect on redistribution.[14]

Likewise, the price control measures have not been effective with respect to essential commodities. The rationing system in towns and cities and rationed prices are highly subsidized in favour of the bottom 80-95 percentiles of the population but then benefit more the top 10 percent. In fact the entire public distribution system is found to be distributing benefits in inverse ratio to the needs of the beneficiaries.[15]

The more direct efforts at redistribution of income, through redistribution of assets, has not been very successful either.[16]

The Employment Guarantee Scheme, introduced in Maharashtra in 1974-75, however, has been a successful effort in increasing the basic needs income of the poor. 163.5 million mandays of employment were generated in 1978-79. A significant proportion of beneficiaries, including amongst scheduled castes and tribes, were women.[17] However, Lakdawala (op cit), commenting upon this scheme, cautions that knowing the special features of the Maharashtra State and its relatively efficient bureaucracy one may be doubtful of the scheme's success elsewhere. One is therefore left with select social services like education, housing, nutrition and health, to see the degree of achievement and the impacts created.

---

14. Draft Five Year Plan 1978-83, p.18 cited in Lakdawala (ibid)
15. Rudra (op cit p.36)
16. Ibid p.28
17. Dandekar, K., 'Tackling of Unemployment Problem through Employment Guarantee', Round Table Conference on Employment, IEA-Indian Economic Association, Poona, March, 1980.

(i) Education: The Constitution of the country set 1970 as target date for universal primary as well as secondary education. However, even till 1973-74 enrolments in the age group 5 to 11 was estimated to be at most 84 percent and that in the age group 11 to 14 only 40 percent.[18] These are, of course, only the gross enrolment rates, the breakup of which into boys and girls gives an alarmingly low enrolment figure for girls. Table 1.1 furnishes this information for classes I-V and VI-VIII across the different states. It is found that enrolment among girls which is less than 40 percent for class I drops down to about 25 percent for class VIII.

So far reference has been made to the enrolment figures. The dropout rates are known to be alarmingly high. It is estimated to be about 80 percent for classes I to V and declines to about 37 percent at class VI-VIII level. (see table 1.2, Enrolment Level). While the benefits accruing from education have not been quantified, the cost of education per capita has been found to be rising from Rs. 3.2 in 1950-51 to Rs.18.2 in 1970-71. (See Table 1.3 National Income and Expenditure on Education). A more detailed picture of per student costs for elementary and secondary education across different states is quite revealing (See Table 1.4 Details of Expenditure, Enrolment and Cost per Student). The cost per student for elementary education for the year 1975-76 is shown to vary from Rs. 66 for Uttar Pradesh to Rs. 250 for Himachal Pradesh, and from Rs. 149 for Bihar to Rs. 385 for Madhya Pradesh respectively. One has to add to this the social costs of inability to maintain the desirable teacher-taught ratio, and the poor quality of education imparted vis-a-vis the social needs for functional education.

There is also evidence that in India there has been a clear bias for expenditure on higher education. Higher education has not only an urban bias but serves primarily the growth of the modern sector, which due to its internal linkages has little beneficial impact on the weakest section of the population.

---

18. Rudra (op cit p.40)

(ii) Health: The results of this social service are by far most visible and laudable. This is reflected in the life expectancy at birth figure that has gone up from 46.6 years to 52.6 years for male and 44.7 years to 51.6 years for females in the last decade. This remarkable change has been due to decline in infant mortality rate from 120 per thousand to 110 per thousand during the same period. With the assistance of W.H.O. the major communicable diseases such as small-pox, malaria, and tuberculosis have been brought under control.

This overall success, however, does not imply that there have been no shortfalls in the fulfilment of targets or that the health services are equally accessible to all, in all parts of the country. Thus, it is estimated that only 32 percent of the health personnel of India work in rural areas.[19] Little wonder that the death rate in rural areas is approximately twice that in urban areas, namely, 16.3 and 9.5 respectively. Although Primary Health Centres and Sub Centres were created to meet this shortcoming, till the Fifth Plan period each catered to 100,000 and 10,000 of rural population respectively.

What adds to this irony is the fact that rural population spends a relatively greater amount on health than on education in contrast to their urban counterparts. The NSS 28th Round reveals that per capita monthly expenditure on education and medicine was Rs 1.36 and Rs 1.40 in urban areas and Rs 0.26 and Rs 1.02 respectively for the rural areas.[20]

Another feature about health services in the country that does not catch the eye when looking at aggregated data, is the fact that both incidence of diseases as well as the medical and health services across the different states vary greatly. This is shown in tables 1.5, 1.6, and 1.7. Thus, cases of leprosy in 1978 varied from one thousand in Haryana to 783 thousand in Tamil Nadu. Likewise, for tuberculosis, the figures ranged from 2,000 in Tamil Nadu to 162,000 in Madhya Pradesh. As a consequence of differences in the extent of medical facilities, the population served per hospital varied from 40,000 for Kerala to 231,000 for Madhya Pradesh. Thus, it is clear that with increasing population

---

19. Annexure 4 to Bachue BN India, SRI Interim Report, May 1980.
20. Cited by Lakdawala (op cit, p.11)

and costs of medical facilities, it would take quite some time for all the states to come anywhere near desirable norms.

(iii) Housing: Despite the number of housing schemes for different income classes and particularly the 'minimum' house scheme for the weaker section of the population, 1971 census revealed that housing shortage was of the order of 11.6 million units in the rural and 2.9 million units in the urban areas. Not all houses in India could be classified as permanent (with roofs made of permanent material such as tiles, metal sheets, brick,lime, stone or RCC). Only 18.9 percent of all rural houses and 64.00 percent of urban houses belong to this category. The majority of the rural houses are semi-permanent and serviceable kutcha (i.e. with roof made of grass leaves, reeds or bamboo, mud, unburnt brick and wood). Such houses not only easily collapse, but also do not serve the full requirement of protection against the environment and disease.

The extent of congestion in housing is also significant. Thus in 1971 50 percent of urban and 47 percent of all rural houses were one roomed houses. Another 28 percent two roomed. The average family size being about 4-5 one can get an idea of congestion*. (See also Table 2.1 in Chapter 3). The living conditions in the urban slums, with respect to water supply and disposal of sewage, continues to be deplorable.

(iv) Nutrition: Putting aside the controversy on the norms of minimum calorie requirement that range from 2000 to 2400, it is estimated that on average only two states with only 11.4 percent of the country's population get more than 2400 calories per day.** Besides, high inter-state variations also exist with respect to average calorie intake as can be seen from table in Appendix A. Thus 39 percent of the population in the States of West Bengal, Bihar, Kerala, Gujarat and Tamil Nadu gets less than the minimum prescribed norm of 2000 calories per day. The impact of the extent of undernourishment and malnutrition on health, learning and productivity, though not estimated, would be by anyone's imagination quite high.

---

* For Rural Urban breakup, See Table in Chapter 3.

**Report on the National Commission on Agriculture.

Table 1.1: Enrollment of Girls in Class I, V, VIII

Year 1973

States	Class I		Class V		Class VIII	
	Girls (Lakhs)	% of Girls to Total	Girls (Lakhs)	% of Girls to Total	Girls (Lakhs)	% of Girls to Total
Andhra Pradesh	5.51	40	1.71	38	0.56	29
Assam	2.66	42	0.66	39	0.45	36
Bihar	4.96	28	1.09	24	0.33	19
Gujarat	4.95	40	1.42	36	0.72	33
Haryana	0.94	32	0.41	28	0.23	22
Himachal Pradesh	0.47	41	0.22	35	0.09	24
Jammu & Kashmir	0.44	36	0.17	30	0.09	24
Karnataka	5.61	46	1.38	38	0.61	34
Kerala	3.07	48	2.51	47	1.31	48
Madhya Pradesh	6.35	38	1.09	28	0.51	23
Maharashtra	9.40	44	2.68	36	1.05	32
Orissa	3.51	39	0.65	33	0.21	23
Punjab	2.50	44	0.97	41	0.53	35
Rajasthan	1.40	24	0.51	22	0.23	17
Tamil Nadu	6.83	45	3.00	41	1.27	36
Uttar Pradesh	12.88	36	2.33	26	1.20	18
West Bengal	10.66	41	1.58	37	1.15	35

Source: Interim Report of the Working Group on Universalisation of Elementary Education, '78, Ministry of Education and Social Welfare, Government of India.

Table 1.2 : Enrolment Level

State	Class I - V		Class VI - VIII	
	Proportion of age level enrolled (%)	Representation Index*	Proportion of age level enrolled (%)	Representation Index*
Punjab	107.1	1.228	50.9	1.393
Kerala	105.9	1.228	88.4	2.420
Tamil Nadu	101.5	1.228	47.9	1.311
Maharashtra	98.0	1.204	43.3	1.185
Gujarat	94.4	1.160	42.0	1.150
Uttar Pradesh	91.8	1.128	34.9	0.955
West Bengal	83.7	1.028	32.9	0.901
Orissa	78.8	0.968	22.2	0.608
Karnataka	78.2	0.961	43.1	1.180
Haryana	71.7	0.881	40.0	1.095
Andhra Pradesh	70.9	0.871	25.3	0.693
Assam	65.4	0.803	35.0	0.958
Madhya Pradesh	62.2	0.764	25.7	0.703
Rajasthan	60.4	0.742	21.5	0.588
Jammu & Kashmir	60.4	0.742	40.1	1.098
Bihar	59.1	0.726	24.5	0.671
India	80.9		37.0	

Source: Investment in Indian Education: Uneconomic? World Bank Staff Working Paper No. 327 by Stephen P Heynemar.

* Representation Index is obtained by dividing the proportion of primary enrolment in a state by the proportion of the total relevant national population in that age group. This has been worked out by Stephen P Heynemar in his paper 'Investment in Indian Education: Uneconomic? IBRD, 1978.

Table 1.3 : National Income and Expenditure on Education

Year	National Income (current prices) Rs Crores	Total Exp. on Education (all sources) Rs Crores	Per Capita Income Rs	Per Capita Exp. on Education Rs	Total Exp. on Education as % of National Income
1950-51	9530	114	266.5	3.2	1.2
1955-56	9980	190	255.0	4.8	1.9
1960-61	14140	344	306.3	7.8	2.4
1965-66	19990	600	426.1	12.1	3.0
1970-71	31569	1000	577.0	18.2	3.1

Source: Public Sector as an Instrument of Development by Dr V A Pai Panandikar and Arun Sud, CPR, 1979.

Table 1.4 : Details of Expenditure, Enrolment and Cost per Student

State	Elementary Education			High/Higher Secondary Edn.		
	Total Direct Expenditure (Rs Crores)	Number enrolled (in lakhs)	Cost per student (Rs)	Total Direct Expenditure (Rs Crores)	Number enrolled (in lakhs)	Cost per Student (Rs)
Andhra Pradesh	49	41	120	30	12	277
Assam	20	19	105	10	5	210
Bihar	49	56	88	17	10	149
Gujarat	51	41	124	28	10	284
H.P.	10	4	250	8	2	325
J & K	7	4	175	4	2	190
Karnataka	47	34	138	16	5	310
Kerala	58	35	166	44	17	263
M.P.	59	48	123	24	6	385
Maharashtra	109	70	156	72	25	293
Orissa	32	28	114	11	4	288
Punjab	21	16	131	24	11	226
Rajasthan	39	27	144	20	5	376
Tamil Nadu	69	57	121	42	16	259
Uttar Pradesh	87	132	66	63	28	226
West Bengal	38	55	69	33	20	165

Source: 'Education in India' published by the Ministry of Education and Social Welfare, Government of India.

Table 1.5: Incidence of Leprosy and Tuberculosis, as of 1978

States	Leprosy		Tuberculosis	
	Cases ('000)	Cases per '000 Population	Cases ('000)	Cases per '000 Population
1. Andhra Pradesh[2]	628	13.1	116	2.4
2. Assam[1]	12	0.7	+	+
3. Bihar[4]	339	5.7	+	+
4. Gujarat[1]	54	1.7	9	0.3
5. Haryana	1	0.1	19	1.6
6. Jammu & Kashmir[1]	5	1.0	+	+
7. Karnataka[2]	174	5.4	122	3.8
8. Kerala[3]	75	3.2	21	0.9
9. Madhya Pradesh[2]	32	0.7	162	3.4
10. Maharashtra[2]	280	5.0	88	1.6
11. Orissa[1]	237	9.5	10	0.4
12. Punjab[1]	2	0.1	12	0.8
13. Rajasthan[1]	10	0.3	25	0.8
14. Tamil Nadu[1]	783	17.5	2	0.1
15. Uttar Pradesh[1]	163	1.7	+	+
16. West Bengal[2]	380	7.6	+	+
17. Others & Union Territories*	73	+	75	+
India	3252	+	662	+

* Data on TB incidence not available for some

\+ Data not available

1 Based on 1977 population

2 Based on 1976 population

3 Based on 1975 population

4 Based on 1974 population

Table 1.6: Registered Nurses and Midwives, as of 31-12-1976

States	Nurses	Population per Nurse	Midwives (senior)	ANMS & Midwives (Jr.)
1. Andhra Pradesh	9496	5049	7338	6591
2. Assam	2110	8439*	1403	1802
3. Bihar	4994	11964+	3194	774
4. Gujarat	3414	9060*	2953	2864
5. Haryana	936	12200*	396	633
6. Himachal Pradesh	113	32796*	162	93
7. Karnataka	2739	11847	4546	5859
8. Kerala	7420	3165**	7104	2466
9. Madhya Pradesh	5750	8203	5677	4440
10. Maharashtra	27130	2077	19326	9535
11. Orissa	2244	11082*	1745	-
12. Punjab	12209	1248*	9116	4782
13. Rajasthan	4177	7084*	2317	4426
14. Tamil Nadu	18603	2402*	23945	3435
15. Uttar Pradesh	5312	18332*	6542	6588
16. West Bengal	6808	7313	5521	7098
Total@	113455	N.A.	101285	61386

Source : Nursing Council of India

* Based on 1977 population

** Based on 1975 population

\+ Based on 1974 population

@ Includes other states and union territories

Table 1.7 : Number of Hospitals, Dispensaries, and Beds (all types), with Population Coverage (1977)

	Hospitals	Dispen-saries	Beds (all types)	Popu-lation 1977 (Million)	Population Served ('000) Per Hosp.	Per Disp.	Populn served per bed
1. Andhra Pradesh	468	813	32461	47.9	102	59	1477
2. Assam@	60	432	6867	17.8	297	41	2593
3. Bihar**	216	468	23803	59.7	277	128	2510
4. Gujarat	201	564	22452	30.9	154	55	1378
5. Haryana	82	236	8308	11.4	139	48	1375
6. Jammu & Kashmir	35	648	5214	5.2	149	8	1000
7. Karnataka*	213	1191	30695	32.4	152	27	1057
8. Kerala+	589	648	52744	23.5	40	36	445
9. Madhya Pradesh*	204	587	18600	47.2	231	80	2536
10. Maharashtra*	762	1825	71152	56.3	74	31	792
11. Orissa	245	322	11876	24.9	102	77	2094
12. Punjab	145	677	13246	15.2	105	23	1150
13. Rajasthan	208	741	19489	29.6	142	40	1518
14. Tamil Nadu	373	757	45811	44.7	120	59	975
15. Uttar Pradesh	716	1142	51329	97.4	136	85	1897
16. West Bengal*	340	435	51982	49.8	146	114	958
17. Others & Union Territories	239	1025	29842	16.5	69	16	552

* Relates to period 1976

** Relates to period 1974

\+ Relates to period 1975

@ Includes Mizoram

CHAPTER 2

INDIA BASIC NEEDS:

A SOCIO-ECONOMIC AND DEMOGRAPHIC SIMULATION MODEL EMPHASIZING BASIC NEEDS

2.1 Need for quantitative approaches towards planning for Basic Needs

The general failure of five year plans during the first two decades since their inception to improve the standard of living of the poorer sections of the society are compelling planners and policy makers to review the basic strategy of planning. Though commendable progress has been achieved on the industrial front, the rate of growth of the economy as a whole was not impressive mainly due to the rapidly growing population and the sluggish growth of productivity in agriculture* (that of land and labour), which accounts for nearly half of the gross domestic product. Even the so called gains of development failed to reach the lower strata of the population as there was no effective mechanism either to transmit them or to intensify and accelerate the 'trickle down' effects.

It is essential to view this in the light of the fact that nearly 80 percent of the population lives in rural areas where agriculture and allied activities constitute the major source of income. It is but natural that if industrial and services activities are concentrated in urban areas the benefits accruing to the rural population will be limited unless, of course, the rural sector is meeting the growing demand for labour in urban areas. While meeting the continuous demand for labour in the urban area, this also reduces the seasonal unemployment and under-employment in the rural areas and increases the productivity of rural labour. In the ideal case one would even expect a gradual and progressive mechanisation in agriculture as a cause as well as consequence of the migration of rural labour to urban areas. Unfortunately, this has not been happening in India.** Urban employment in the organised sector has kept pace

---

* This is not to under-estimate the positive effects of the green revolution, but it was concentrated only in a few regions and over a few crops and the beneficiaries, in general, were medium and large farmers.

** Nair, K.N.S., 'Technological Changes in Agriculture - Impact on Productivity and Employment'.

with neither investment nor output, with the result that the rural to urban migration has primarily contributed to the growth of urban slums and to the informal sector.

All these factors are leading to a general consciousness that unless and until specific programmes directly related to the weaker and vulnerable sections of the society are undertaken, their conditions will either remain the same or deteriorate. Now both state and central government agencies are formulating various time-bound programmes which have some bearing on the standard of living of the poorest. But in a country like India with limited financial resources and innumerable competing needs it is imperative that these resources be utilised with utmost care.

2.2 Why Quantitative Approach?

Let us suppose the government has two programmes - one to reduce the fertility rate and other to increase the literacy rate. If they are not operated simultaneously then the literacy programme followed by fertility programme may be a better strategy compared to the reverse order. Again, the order in which the programmes are implemented may not be very relevant if fertility programmes are mainly based on cash/economic incentives.

Very likely a literacy drive programme gives high emphasis to female enrolment rates and to a reduction in their drop outs. It might lead to the average age of females at marriage going up which is a significant factor in reducing fertility rate. At the same time it might also lead to higher life expectancy, higher female labour force participation rates ...and to higher unemployment rates and to a higher rate of migration from rural to urban areas which might cause the rural per capita income to rise and urban per capita income to fall etc. Thus even this seemingly simple developmental programme affects almost all spheres of social and economic activities. Some of these effects might taper off or get strengthened over time. The problem becomes more complicated if policy variables and their cost-effectiveness are to be identified. Thus it might turn out that before going for an intensive educational programme for females, steps have to be taken to reduce the labour force participation rates in the corresponding age groups (or parents have to be made aware of the need for educating their wards) or measures, social

or institutional, have to be taken to increase the age at marriage of girls, or to subsidize food, clothing and teaching materials, and so on. Now it should be noted that each of the above mentioned steps are inter-dependent among themselves and also dependent on a number of other socio-economic and demographic factors, though the degree of dependence varies spatially as well as temporaly. Some of these interdependences or linkages are too significant to be over looked.

In short, developmental policies - whether they are social, economic, demographic, or political - are not independent; a suitable quantitative frame work is necessary to identify, estimate and analyse various linkages. Though one would like to quantify the entire developmental process, it is well nigh impossible to take into account all the quantitative and qualitative factors even in the most sophisticated model. Nevertheless, a general model incorporating the more basic features of economic development can be used on an effective tool for planning and policy making - provided the various interdependencies and linkages are explicitly introduced. This is all the more significant in the more recent approach towards planning where economic growth is to be achieved with social justice, in terms of the satisfaction of selected basic needs of weaker sections of the society.

2.3 Systems Simulation Models for Planning for Basic Needs

Lack of clarity and understanding of various socio-economic and demographic factors, and their interrelationships, leads to misconceptions and sometimes to the pursuit of wrong or untimely policies. Because so many of the issues in developmental studies are empirical in nature, wide options should be available to the model builder to test a variety of hypotheses and to select the ones which are empirically consistent.

The general failure of the earlier plan models to improve the standard of living of the target groups has now clearly brought out the need to study and understand policies related to the satisfaction of basic needs. This must be done in the context of certain peculiar aspects of the economy, such as its dualistic nature; the inter regional disparities; the growing population and rising unemployment; the existence of higher wage rates and higher unemployment rates in certain sectors; sectoral

linkages; production capacities and constraints; the existence of a more or less rigid income distribution system; savings, investment, and consumption patterns; government interventions in terms of regulations, nationalisation and 'distribution of essential commodities'; sector-wise export and import strategies; and so on. It is to be noted that since all these factors are inter-related, a partial approach in analysing any particular policy is defective and may be misleading. Systems simulation is more and more used as an appropriate tool in this respect.

With a properly structured simulation model, an underdeveloped country can test out alternative policies and evolve optimum strategies to achieve targets of satisfying selected basic needs. Their effects can be studied over a period of time under a variety of assumptions about external conditions, and the policies tuned accordingly. Thus systems simulation models are becoming firmly established as an integral part of the planning and development process, especially in the developing countries.

The present simulation model developed at Systems Research Institute is the first result of an attempt to evolve a quantitative frame work to help planners and policy makers to evaluate and compare alternative policies over a period of time from a systems point of view.

2.4 Structure of the Model

The structure of our model with the exception of the Basic Needs subsystem is almost the same as that of "Bachue International" - an econometric model which is concerned with tracking various demographic, economic and income distribution variables over time. It was constructed in 1978-79 by Prof R Scott Moreland for ILO and is estimated using cross sectional data for a number of developing countries. The main differences between the India-Basic Needs model and Bachue International are explained in Appendix G.

Our model is primarily meant to simulate socio-economic and demographic factors on an yearly basis over a long period. The period of Simulation has been taken as thirty years from 1970-71 to 2000-2001, though this can be reduced or extended for specific purposes.

The structural specifications of the model can be broadly grouped under three subsystems namely demographic, economic and income distribution,

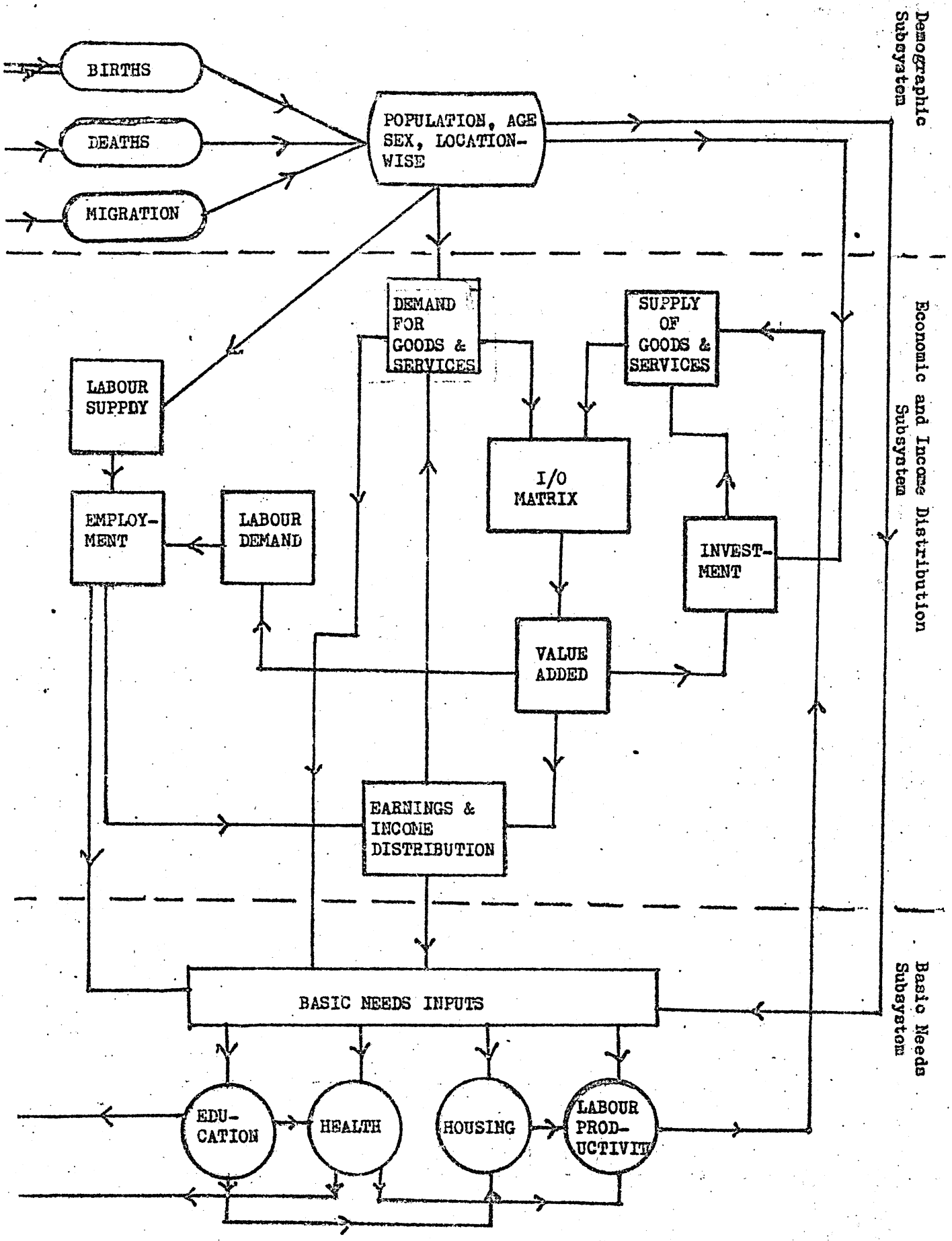
and basic needs satisfaction. In Figure 2.1 we present a schematic overview of the model with the main inter-relationships of the demographic, economic, and basic needs subsystems.

The demographic subsystem consists of disaggregated population, labour force participation rates, and some of the demographic characteristics like fertility rates. The disaggregation of population into rural and urban, male and female and into 5-year age groups is very useful in analysing factors related to the composition of population. For example many of the socio-economic and demographic variables such as enrolment rates, labour force participation rates, fertility rates, and dependency ratiosare influenced by the age-wise distribution of population. Net migration in different age groups from rural to urban areas is also very important in studying the growth of population and employment in rural and urban areas.

Propensity to migrate is to a large extent caused by regional imbalances and differential growth rates of regions. In the present model, regions have been differentiated only in terms of "rural" vs. "urban", and as such only the net migration propensity from rural to urban is considered.

The economic subsystem specifies the determination of national income, employment and income distribution. The economic activities are grouped under 10 sectors including a basic needs sector (consisting of education, health and housing). Since the model gives heavy emphasis on basic needs satisfaction of the population, it was felt necessary to incorporate such a sector explicitly in the I/O matrix. Private aggregate consumption and investment are estimated through behavioural equations. Final demand is always adjusted to sectoral production constraints due to capacity limitations. Sector-wise exports and imports are also taken into account.

However, the model is essentially a disequilibrium one. For example some savings gap and a balance of trade gap are allowed to exist within a reasonable range.



An Overview of the Model.

The unemployment rate is determined from the growth in labour force and sectoral capacity. Sector-wise employment is derived from unemployment rates and labour supply. Work force is classified into (i) employees, and (ii) employers and self-employed, and further into rural and urban in each sector. Sector-wise average earnings of employees and employers, and the overall income distribution are computed.

The basic needs subsystem specifies some of the basic needs satisfaction of the population such as calorie consumption, health, education, availability of commercial energy to the household, change in labour productivity, etc. At present we have not attempted to estimate the basic needs satisfaction of any specific strata of the population such as the bottom twenty or forty percent of the population. Work in this direction is in progress, however, as this is an important aspect of most of the policy analyses, and we hope to incorporate this aspect into the model in the near future.

2.4.1 Demographic Subsystem

In the demographic subsystem we are concerned with tracking the population in each period by age and sex, rural-urban location, and also the supply of labour force. The size of the rural and urban population and labour force as well as the age distributions are important variables in the economic and income distribution and basic needs subsystems. An overview of the demographic subsystem may be obtained from Fig. 2.2. The model endogenously predicts crude birth rate, the female labour force participation rate and the propensity of the rural population to migrate to urban areas.

Since the age distribution of female population itself has a tendency to change, age-specific fertility rates would also be desirable. However, this could not be undertaken due to lack of relevant data. Presently only the overall fertility rate has been estimated. Infant mortality is often included as an explanatory variable for fertility as couples tend to replace the infant lost. Life expectancy at birth has been used as a proxy variable for infant mortality. Though it appears desirable to include the female labour participation rate also, it was not found empirically to be the case that higher female labour force participation reduced the birth rate. In rural areas female labour force participation

rates are higher and birth rates too are high compared to urban areas. Literacy has been tried, however, and though the sign is correct, the co-efficient is not statistically significant. Perhaps this was because of the unsatisfactory measure of literacy.' The intensive family planning programmes ought to affect the fertility rates. We have taken "percentage of couples protected under family planning programme" which gives the effectiveness of family planning and is assumed to grow at a rate exogenously specified.

The rural and urban fertility rates have been disaggregated from overall fertility by maintaining a constant ratio (empirically determined) between rural to urban fertility rates.

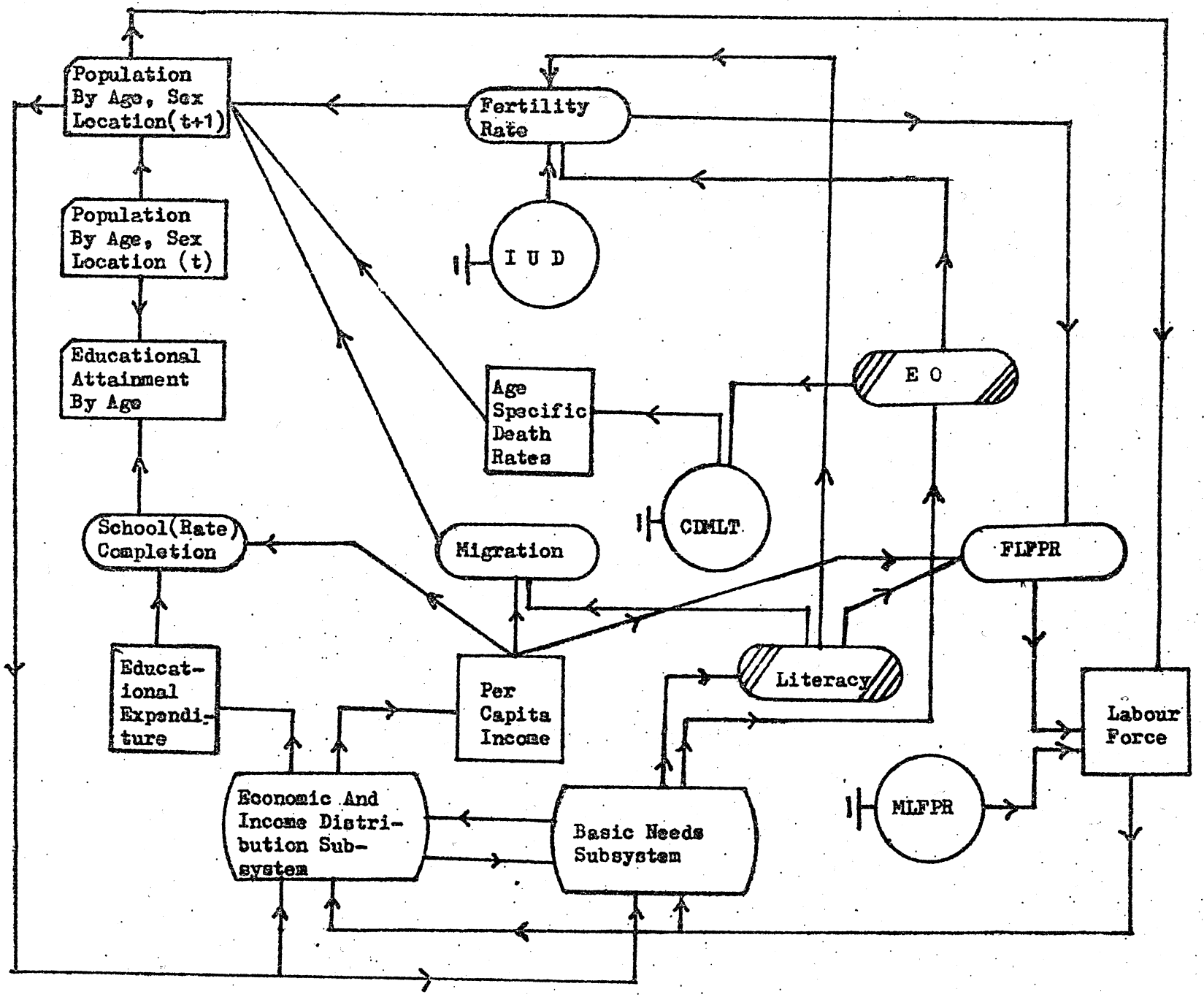
Migration

The important factors which determine the (rural to urban) migration propensity are the relative income differences and education. If the difference is greater, more people would go to urban areas to earn more money. Those with higher education have more opportunities and are more aware of them than their less educated rural counterparts. Thus they have a relatively high incentive to migrate compared to less educated rural people.

Female labour force participation rate

Though it is desirable to estimate labour force participation rates for rural and urban populations and for specific age groups (for example, 0-14, 15-24, 25-59 and 60+), selection of related explanatory variables turned out to be difficult and hence it has been estimated for overall female labour force. The male labour force participation rate is assumed to be constant.

With respect to female labour force participation rate, there are three potentially important determinants: (1) Fertility, (2) Income, and (3) Education. Fertility needs little explanation. Income may play the role of level of development (directly or indirectly). Education is expected to increase labour force participation rate of women as in the theory of the economic household, the opportunity cost of their not working is usually seen to rise with education (Moreland, 1978).



SYSTEMS RESEARCH INSTITUTE

The age-wise and sex-wise projection of population is done using the survival probabilities for each age and sex (from the Coale Demany Tables).

2.4.2 Economic and Income Distribution Subsystem

The core of the economic subsystem is an input-output matrix. The economic activities are classified into 77 sectors which have been condensed into 10 sectors, viz. Food, Other Agriculture, Basic Needs, Textiles, Chemicals, Heavy Industries, Light Industries, Construction and Transportation, Energy and Services. However, these seventy seven sectors can be reclassified suitably as needed to study certain selected policies. The ten sector inter-industry flow presently used and the description of sectors are given in Appendix E. An overview of the major economic interrelationships in this subsystem is given in Fig. 2.3

Final Demand

Final demand consists of private consumption and investment, government consumption and investment, imports and exports.

Private consumption

Per capita consumption demand is assumed to be a function of per capita expected income, percentage of child population and share of income going to the low 20 percent of the population. (see E 10)*

The Rural and Urban consumption patterns for the three sectors primary, manufacturing and services have been estimated separately as functions of expected per capita income and child population. (see E 11 to E 16)

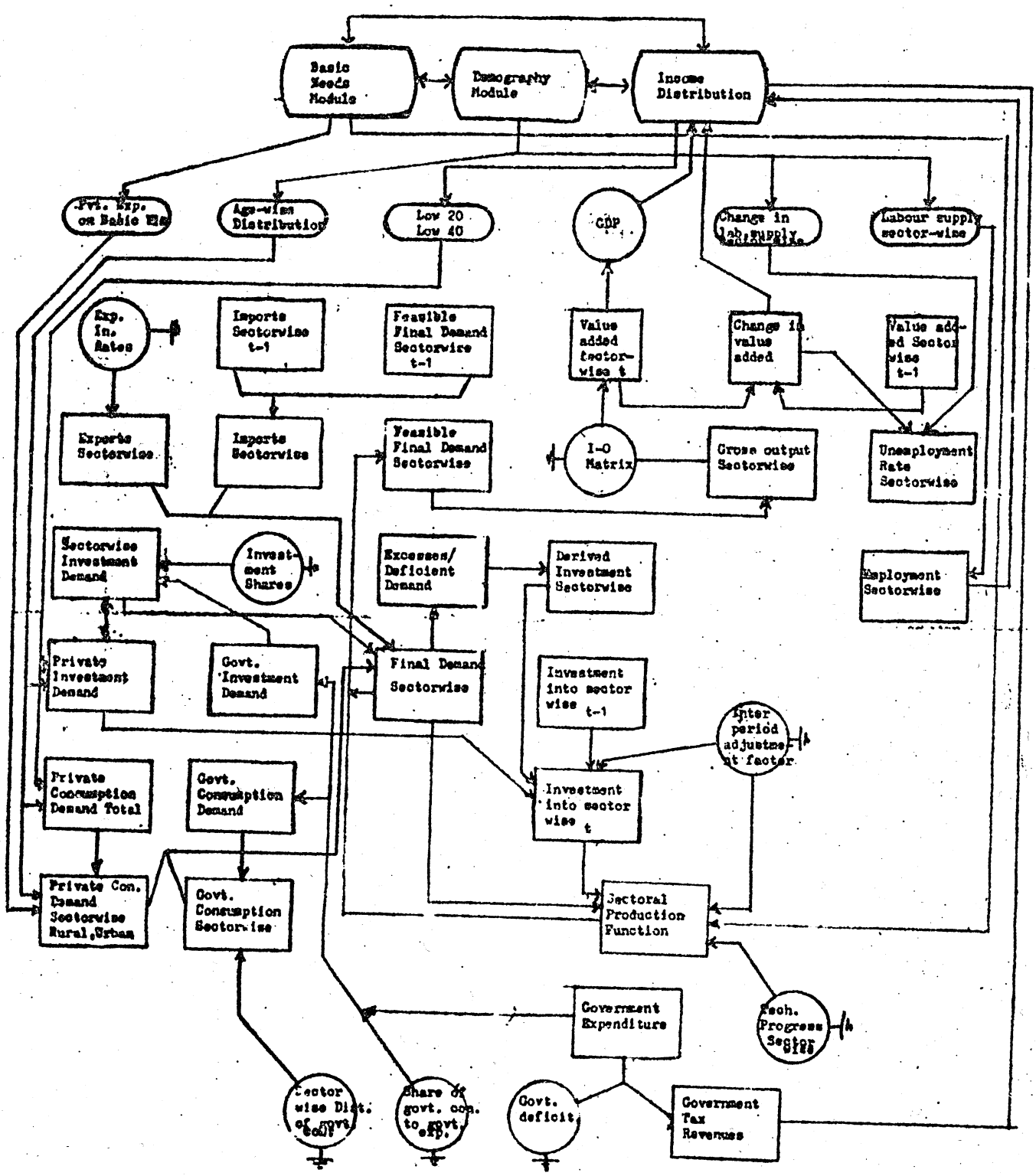
Sector-wise distribution of consumption within each of the three groups is obtained from exogenously specified disaggregated shares of the sectors. (see E 22 to E 26)

Private Investment

Per capita private investment demand is determined by expected per capita income, child population and share of income going to the lowest 20 percent of the population. (see E 34)

---

* Equations are given serially in Appendix E.



ECONOMIC SUBSYSTEM

Private investment demand from each sector is determined by exogenously specified shares b_i.

$$PINV_i = b_i \; PINVST$$

The distribution of total private investment into each sector is described later, below.

Government Consumption and Investment

Government expenditure (GOVT) consists of tax revenue (TAXREV) and deficit spending (DEFICIT). Profits of government controlled/owned firms are viewed as part of the tax revenues earned via profit taxes. This "tax rate" can be used as a policy variable to represent the degree of nationalisation in a particular industry.

$$GOVT = TAXREV + DEFICIT$$
$$GCONT = (a_T)\; GOVT$$
$$GCON_i = a_i \; GCONT$$
$$GINV_T = (1-a_T)\; GOVT$$
$$GINV_i = b_i \; GINVT$$

where

GCONT = total government consumption demand

$GCON_i$ = government consumption demand in ith sector

GINVT = total government investment demand

$GINV_i$ = government investment demand from the ith sector

a_T, a_i and b_i are exogenously determined parameters.

Exports and Imports

Exports are assumed to grow at an exogenously set rate (e_{it}) in each sector and imports are initially assumed to be a fixed proportion of final demand where the proportion is determined from the previous period. (see E 36, E 37)

Domestic Final Demand, Total Output and Value Added (Unadjusted)

Using the Leontief inverse, unadjusted output/Y_i and value added are obtained after estimating the final demand.

Final Demand Adjustments

The constraints on sectoral value added due to sectoral production constraints act as constraint on net final demand. Hence, all the components of final demand except investment are adjusted if the capacity constraints imposed by the sectors are not met.

Unadjusted current capacity (X_{it}) is given by

$$X_{it} = \frac{1}{k_i} I_{it-1} + \hat{X}_{it-1} (1+r_i+q_i)$$

where $\hat{X}_{it}$ is the adjusted capacity, (r_i) is the exogeneous technical progress, k_i is the sectoral incremental capital-output ratio and q_i is the change in labour productivity per unit of output.

Desired investment I^*_{it} is defined as

$$X^*_{it} = (Y_{it}-X_{it-1})\, k_i \quad \text{for } Y_{it} > X_{it-1}$$

$$I^*_{it} = \frac{I_{it-1}}{\sum_{i=1}^{10} I_{it-1}} \sum_{i=1}^{10} I_{it} \quad \text{for } Y_{it} \leq X_{it-1}$$

Complete adjustment is not allowed so that current investment is also proportional to previous period's investment. Thus, the actual investment by sector is given by

$$I_{it} = I_{it-1}\, \delta + I^*_{it} (1-\delta) \qquad 0 < \delta < 1$$

$$\text{subject to } \sum_{i=1}^{10} I_{it} = PINVT_t + GINVT_t$$

Since the model does not take into account the capital stock at any point of time, the depreciation (D_{it}) could not be computed as a function of capital stock. It is assumed to be a function of the previous period's investment and also as a function of the rate of growth of value added to take care of the intensity of usage.

$$D_{it} = d\, I_{it-1} + f \left(\frac{VA_{it} - \hat{VA}_{it-1}}{VA_{it-1}} \right), \quad d \text{ and } f \text{ are exogenously specified parameters.}$$

Thus the adjusted capacity in each industry is calculated as follows:

$$\hat{X}_{it} = \frac{1}{k_i} (I_{it} - D_{it}) + \hat{X}_{it-1} (1+r_i+q_i)$$

Adjustment of Final Demand

The final demand has to be adjusted to the capacity existing in each industry. The feasible final demand $(\hat{Z})$, (i.e. the amount of final demand which could be met by the existing capacity) can be obtained as follows:

$$\hat{Z} = (I-A)\hat{X}V$$

where V is a diagonal matrix with $V_{ii} = 1 - \sum_{j-1}^{10} a_{ji}$

Private and government consumption, import and export are adjusted due to excess/deficient capacity. However, private and government demand for investment goods are not adjusted as these expenditures are considered as "committed". In the presence of deficient capacity, some demands will not be met. But the adjustment is only partial if there exists excess capacity - as an implicitly "downward sticky" price mechanism is assumed. In other words spare capacity is allowed to exist. Presently the model does not take into account inventories and hence this could not be utilised to adjust the capacity.

All components of final demand (except investment) are adjusted to the shortfall (or excess) in feasible demand $(Z-\hat{Z})$ in proportion to their size. Let Q_i be the difference between the unadjusted demand and the feasible demand.

$$Q_i = Z_i - \hat{Z}_i \quad \text{if} \quad Z_i > \hat{Z}_i \quad \text{and}$$

$$Q_i = (Z_i - \hat{Z}_i)\,\phi \text{ if } Z_i < \hat{Z}_i , \quad 0 < \phi \leq 1$$

The adjustment equations are given in Appendix B.

Imports are assumed to adjust in the opposite direction than demand for home produced goods.

With the adjusted final demand vector the adjusted value added is calculated and then the gross domestic product is obtained

$$GDP = \sum_{i=1}^{10} \hat{VA}_i$$

Employment

Labour supply: The supply of labour force to each industry in rural and urban areas is assumed to be in proportion to the previous period.

Sectorwise unemployment rate is assumed to be a function of the growth rate of labour force and the capacity in each sector existing in rural and urban areas. No attempt has been made to differentiate the labour force in terms of quality and skill. The employment is then derived residually from the labour force for each sector in rural and urban areas. (see E 56 to E 61)

The Income Distribution Subsystem

For the purpose of analysing the income distribution the work force is divided into two categories: employees, and employers/self employed. Since each sector is also divided into rural and urban, there are therefore forty classes of earnings.

Profit and Wages: The share of wages in GDP is calculated according to a behavioural equation

$$\ln \alpha_i = a_i^1 + b^1 \ln (YP) \qquad 0 < \alpha_i < 0.9$$

Where α_i is the share of wages in value added in the ith sector. The sectoral wages are given by

$$W_i = \alpha_i \hat{VA}_i$$

The share of sectoral value added not distributed as factor payments is assumed to be a fixed proportion of value added,

$$K_i = \gamma_i \hat{VA}_i$$

Hence profits or non-wage factor payments are obtained by

$$\Pi_i = \hat{VA}_i - W_i - K_i$$

Workforce Status: The division of workforce into employees ($EMPW_i$) and employers/self employed ($EMPB_i$) in each sector is done according to empirically determined proportions.

$$EMPW_i = \epsilon_i E_i$$

$$EMPB_i = E_i - EMPW_i$$

Mean earnings by class and sector: Before calculating the mean earnings of the employers, a profit tax (t_i) is imposed.

Mean earnings by sector are then,

For employees : $w_i = W_i / EMPW_i$

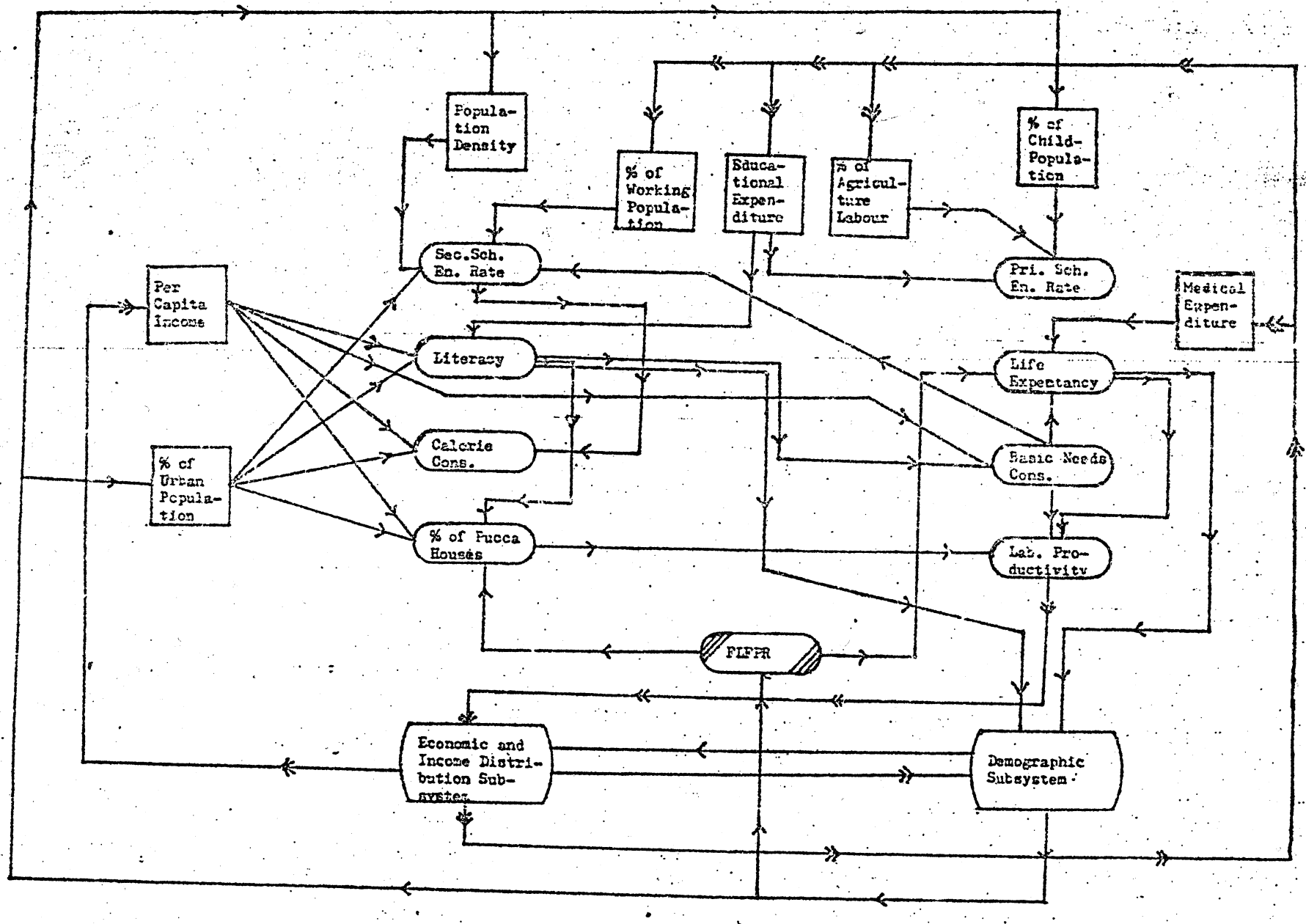
For employers and self employed $P_i = \Pi_i (1-t_i) / EMPB_i$

The distribution of earnings is assumed to follow a lognormal distribution. This can be done for each of the forty groups of persons. However, for lack of computer time, only the over-all distribution is computed at present. It is intended to substitute a different lognormal algorithm and to compute at least four different distributions which will be added to give the overall distribution.

2.4.3. Basic Needs Subsystem

The basic needs module is specified as a recursive system and consists of the equations for literacy, private expenditure on other basic needs, primary school enrolment, secondary school enrolment, female life expectancy, percentage of pucca and semi-pucca housing units to total housing units, per capita calorie intake, change in labour productivity (Rs./worker), and availability of commercial energy for domestic purposes. The major interrelationships in this subsystem are given in Fig. 2.4. The estimated equations are given in Appendix B. (See B 1 to B 13)

Literacy Rate: This variable exhibits wide variations across different states. Even within a state it varies considerably between Rural and Urban and also between Male and Female as is brought out by the following table.



Basic Needs Subsystem.

States	Literacy Rates (percent)			
	Rural		Urban	
	Male	Female	Male	Female
Andhra Pradesh	27.3	10.9	57.3	36.3
Gujarat	38.9	17.2	64.0	44.8
Kerala	65.6	53.1	72.0	60.6
Maharashtra	43.2	17.8	66.9	47.3
Punjab	34.7	19.9	58.5	45.4
Tamil Nadu	45.1	18.9	66.8	45.4
India	39.55	15.52	69.83	48.84

Presently no attempt has been made to estimate literacy rate equations for males and females and also for rural and urban areas separately. The literacy rate specified in the model refers to the over-all literacy rate. Public (BEDEXP) and private expenditure on education are the most important variables determining the level of literacy in a developing economy. The greater the public expenditure on education the higher will be the enrolment in the lower levels of education, viz. primary and middle.

A higher per capita income generally leads to higher expenditure on basic needs and hence on education too. Per capita income has also been used as an explanatory variable. The third factor which could affect literacy is urbanisation. This may be due to two reasons. First the availability and accessibility of educational institutions are better in urban areas rather than rural. Secondly farm labour activities are generally low in urban areas and hence the demand for child labour may be relatively low.

In the absence of data on private expenditure on education, per capita total expenditure on basic needs (BNT) has been tried as a explanatory variable. However, it was found that BNT was highly correlated with BEDEXP so it was excluded from the final equation.

Though the estimated coefficients have the expected signs, they are not statistically very significant. (see B 1)

Per capita private consumption expenditure on Basic Needs

Private expenditure on basic needs (excluding food) is primarily determined by per capita income. Basic Needs, as defined here, consists of education, health and housing. The nutrition aspect is not included as we treat it separately. In less developed countries, education, health, etc. may be considered to be luxury items and so their income elasticity can be expected to be greater than one.

Literacy is also considered to be an important variable affecting private expenditure on Basic Needs. For example, for a given income level, a higher literacy rate might imply a better understanding of the necessity for acquiring certain 'basic needs' such as better health through increased expenditure.

As expected partial income elasticity is greater than one in the estimated equation. The coefficient of literacy is also positive and significant. (see B 4)

Primary School enrolment rate

As mentioned earlier, higher the public expenditure on education greater will be the enrolment rate in the primary and middle school, as they become more subsidized. Also if the proportion of agricultural labour in the total labour force is higher, the enrolment would be lower. For, higher the proportion of agricultural labour in the total labour force greater will be their dependence on the rural sector and on agriculture in particular. Higher dependence on agricultural and related activities increase the participation rate of children of school-going age in labour force which, in turn, reduces their chances of attending educational institutions.

Another factor which may have some bearing on primary school enrolment rate is the percentage of children in the school going age group to total population. The argument is that given the public expenditure on education a faster growth of children in the school-going age group compared to the population (i.e. more children per family) might reduce the primary school enrolment rates due to supply constraints. In other words the probability of getting a child enroled in primary school is inversely proportional to the number of children per family.

So we have taken the primary school enrolment rate as a function of education expenditure, % agriculture labour force and % of children to the total population. All the estimated coefficients are statistically significant with expected signs. (see B 5)

Secondary School enrolment rate

Urbanisation may be considered to be one of the important factors affecting secondary school enrolment since educational facilities are more easily available in urban compared to rural areas. Private expenditure on basic needs also determines the level of enrolment. Per capita income may also influence the level of enrolment. However, in the estimation, its coefficient was found to be negative and statistically insignificant. Thus one may possibly argue that a higher per capita income by itself may be neither necessary nor sufficient to induce a higher enrolment rate. For example in states like Kerala and Tamil Nadu the secondary school enrolment rate is significantly higher than the national average inspite of their low per capita income as can be seen from the following table.

States	Per Capita Income	Secondary School Enrolment Rate	Density
Kerala	507	30.6	549
Tamil Nadu	557	29.1	317
Punjab	811	21.5	269
Gujarat	592	24.6	136

In places where density of population is high, secondary school enrolment is also found to be high. This may be due to the fact that accessibility to education institutions increases with higher density of population as the growth of secondary schools are more extensive than intensive in nature.

All the variables are statistically significant (at 10% level) and have expected signs in the estimated equation. (see B 6)

Life expectancy of females at birth

Generally life expectancy is found to be positively influenced by economic development. If per capita income is taken as an indicator of economic development then one would expect life expectancy to go up with higher per capita income. Surprisingly the available evidence for India suggests that a higher per capita income by itself need not affect life expectancy significantly, as can be seen from the following table:

States	Per Capita Income	Life Expectancy of Females
Punjab	811	45
Maharashtra	700	45
Kerala	507	57
West Bengal	493	46

Government's involvement in public health programmes is one of the important determinants of life expectancy. However, it is very difficult to quantify various programmes and policies of the government towards this by any single measure. Instead per capita public health expenditure is taken as an indicator (BMEXP). Besides BMEXP, the private expenditure on basic needs is also expected to increase life expectancy. Accessibility of health facilities is also an important factor. It may be reasonably assumed that increased urbanisation might enhance the accessibility of health care centres. Besides the available factors, the outlook and attitude of the population, especially that of females are also of prime importance. The female labour force participation rate is used as a proxy variable. It is expected that, in general, a greater participation of females in labour force will significantly influence their awareness and outlook.

In the estimated equation, government expenditure on public health appears to be very significant in increasing life expectancy. Private expenditure on basic needs is also influencing the life expectancy in the expected direction. Female labour force participation rate also has the expected sign and is statistically significant. (see B 7)

Housing

While the number of census households has increased by 16.3 percent from 83.5 millions in 1961 to 97.1 millions in 1971, the number of occupied housing units has gone up only by 14.6 percent from 79.2 millions in 1961 to 90.8 millions in 1971. Thus the number of households without any housing facilities is about 6.3 millions in 1971 compared to 4.3 millions in 1961. It is distressing to note that about 40 percent of the population has only single room dwellings with an average rate of occupancy of about five persons per room. A clear picture of the stress and strains of housing and occupancy can be seen from the table (see p. 23)

Housing, though one of the most important basic needs, is rather difficult to be quantified in terms of a single variable. Added to this is the problem of lack of reliable data. Here, percentage of pucca plus semi-pucca houses* to total number of houses has been used as a measure of the condition in housing.

Per capita income may be considered to be the major factor influencing housing, Other factors which might have a bearing on housing are the awareness and attitudes of people. Two variables, viz. literacy rate and female labour force participation rates have been tried as proxies for awareness.

The competitive nature of basic needs, as mentioned earlier, is very prominent in the case of housing. Improvement in housing has to be at the cost of expenditure on food, health, education, etc. Since at least in the low income groups there is not much scope to reduce the expenditure on food or such other items which are already very low, an improvement in housing may be brought about by a reduction in expenditure on education. (see B 8).

---

* A pucca house is defined as a unit with predominant material of wall and roof as follows:

Wall - Burnt bricks, GI sheets or other metal sheets, stone, cement, concrete etc.

Roof - Tiles, slates, corrugated zinc, or metal sheets, ACC, RBC, RCC, brick lime, stone, etc.

A semi pucca house is a pucca housing unit but for a mud wall or thatched roof.

Table 2.1

Percentage distribution of population by size of dwelling unit occupied

Size of dwelling unit	Percentage of Population					
	RURAL		URBAN		TOTAL	
	1961	1971	1961	1971	1961	1971
1	2	3	4	5	6	7
One room	40.87 (4.4)	39.63 (4.7)	43.52 (4.2)	41.72 (4.6)	41.33 (4.4)	40.04 (4.7)
Two rooms	27.16 (2.6)	28.77 (2.8)	26.14 (2.7)	28.08 (2.8)	26.98 (2.6)	28.63 (2.8)
Three rooms	13.40 (2.0)	14.19 (2.2)	12.55 (2.1)	13.62 (2.2)	13.25 (2.0)	14.08 (2.2)
Four rooms	7.72 (1.7)	7.88 (1.8)	7.29 (1.8)	7.59 (1.8)	7.64 (1.7)	7.83 (1.8)
Five or more rooms	9.45 (1.3)	9.51 (1.4)	9.73 (1.3)	8.95 (1.4)	9.50 (1.3)	9.40 (1.4)
Unspecified number of rooms and details unspecified	1.40	0.02	0.77	0.04	1.30	0.02
All sizes	100.00 (2.6)	100.00 (2.8)	100.00 (2.6)	100.00 (2.8)	100.00 (2.6)	100.00 (2.8)

Note : Figures in brackets are average number of persons per room.

Source : Handbook of Housing Statistics, 1979.

Per Capita Calorie Intake

Calorie intake, in general, depends on the expenditure on food which in turn is influenced by income. Given the income level calorie intake might still vary between rural and urban areas. In fact due to the relatively low prices of food one would expect calorie intake to be higher in rural areas compared to urban. So urbanisation might be considered to be a factor bringing down the per capita calorie intake.

Though calorie intake is the most important basic need it has to compete with other basic needs in the overall basic needs satisfaction. If private education expenditure is high, it could significantly compete with expenditure on food. Secondary school enrolment rate was used as a proxy for private expenditure on education.

The estimated equation gives credence to the contention that for a given level of income any additional expenditure on education is at the cost of expenditure on food. Urbanisation also significantly reduces the per capita calorie intake.

However, the above observations are subject to the following qualifications. Firstly, the competing nature of basic needs depends on their private cost. Secondly even when private costs are higher the substitution effect will be insignificant at higher income levels. (see B 9)

Change in Labour Productivity

An attempt has been made to explain the changes in value added per unit of labour in terms of capital in use per unit of labour and selected basic needs variables.

The expectancy of life is a general indicator of the average morbidity of the population. In general, it may be reasonably assumed that a low level of life expectancy implies a high morbidity and hence low productivity.

Better education standards may also increase labour productivity. Since a significant portion of private expenditure is on education, private expenditure on education is a desirable variable. However in the absence of any such data, per capita private expenditure on basic needs

has been used. This variable may also take care of the influence of private expenditure on health and housing as well. (However, a meaningful analysis may be carried out by dividing the labour force according to different skills and education level. This has not been attempted in the present study.)

Due to lack of data it was not possible to estimate productivity equations for each of the ten sectors. The above equation is a good approximation for light industry. The relative variation in average earnings per labour in this sector with respect to other sectors are used to compute the change in labour productivity in other sectors. (see B 10)

Commercial Energy Availability for Domestic Sector

The phenomenal and continuous rise in oil and oil products prices in the international markets in the seventies has made both the developing and developed countries to formulate alternative energy policies. Unfortunately in many developing countries the orientation, in general, is towards the energy requirements of production and service sectors and urban areas. Thus the energy needs and its availability in the rural areas and particularly of households have been greatly neglected. This is mainly due to the fact that the major portion of the domestic energy requirements is met by non-commercial energy consisting of fire wood, dung and vegetable waste. Since fire wood forms the source of about two thirds of the non-commercial energy, this leads to a faster rate of deforestation which has an adverse effect on the ecological balance and climate. Thus it is imperative to bring up the commercial component of the domestic energy requirements.

Also the share of commercial energy in the total household energy availability is a good indicator of economic conditions.

In the present version of the model no attempt has been made to analyse the demand and availability of domestic energy by different sources and end use or for rural and urban areas separately. Total per capita domestic energy requirement is assumed to grow at a (low) exogeneously specified rate and the commercial energy available for private final consumption is obtained from the final demand vector of the input-out matrix for each year.

Energy availability index is defined as the ratio of commercial energy available for private final consumption to total domestic energy requirement. (see B 11-B 13).

CHAPTER 3

SIMULATIONS WITH THE NATIONAL MODEL

Following the design and calibration of a global model - undoubtedly a massive task - comes the tedious work of examining and analysing its operations and behavioural patterns. The dynamic inter-relationships between variables belonging to different subsystems become explicit only through simulation runs. This becomes particularly necessary in complex socio-economic models like the present one.

3.1 Initialization of the Model

The simulated future states of the economy, say, in the next thirty years are obtained by giving values to input variables of the model for some initial year. The output of the first year then becomes inputs for the next year. Thus, each year's outputs of the model are worked out iteratively. The trajectory of output variables describing the dynamic behaviour of the national economy, given the actual values of initial year inputs, is called the base run.

The year 1970-71 was chosen as the base or initial year of the model. The choice was primarily dictated by the fact that most of the data used for estimation was available for that year. It was also a census year, whence the demographic module is securely based. Another advantage of selecting 1970-71 as the base year was that the validity of the model could be established through comparison of simulated output values with the actual data available for later years.**

The period of simulation is thirty years, 1970-71 to 2000-01 A.D. The input data consisting of initial values of the variables are given in the Appendix C.

** Some other tests such as sensitivity analysis and stability tests have also been conducted and the model was found to be satisfactory.

* The constant terms in the behavioural equations are suitably adjusted so that the predicted values do not differ from actual values for the initial year.

3.2 Base Run Results

The results of the base run of our model are quite realistic though not reassuring. Keeping in view the fact that the model parameters have been estimated on a cross-section basis, it is quite comforting to note that the macro-variables conform to the real set of values closely for the initial few years and generally to what can be expected over the period.

Demographic and Social Subsystem

According to the model, the total population continues to grow at a steady rate of about two percent per annum. In fact due to the decline in mortality figure that are expected from better medical facilities, the decennial growth rate would increase from 20 for 1971-1981 to 22 percent for 1981-91, and thereafter stabilizes during 1991-2001.

Among the demographic results worth noting on the model are: a continuous decline in the total fertility, though at a decreasing rate, from 190/1000 in 1970-71 to 124 in 2001. The crude birth rate registers a decline from 42 in 1971 to 36.6 in 1981, and 30.2 in the year 2001. This does not however get reflected in the overall population growth rate because of the simultaneous rapid decline in mortality during the same period. The model suggests that the female labour force participation will increase, primarily due to greater access to education and reduction in fertility rate, from 19% in the base year to 30% in the terminal year.

The age structure would consequently undergo certain transformation when seen in terms of the male/female, urban/rural breakup. Thus, the percentage distribution of children upto the age of fourteen would declines by 2001, especially for the urban children. (See following table). In contrast the percentage of persons in the age group 15-24 increases from about 15 percent to 20 percent for rural but declines from about 20 percent to 18 percent for the urban areas. Likewise, the age group 25 to 59 increases relatively in urban areas by 2001. This is of course due to continuous rural to urban migration taking place among working age persons.

Age Distribution (Male-Female; Rural-Urban)

Age Group	Year 1970-71				Year 2000-2001			
	Rural		Urban		Rural		Urban	
	F	M	F	M	F	M	F	M
0 - 14	42.48	43.15	40.78	37.33	39.08	38.88	32.54	31.43
15 - 24	15.94	15.58	19.27	19.90	19.37	19.76	18.62	18.43
25 - 59	35.35	34.99	34.68	38.02	34.79	35.23	42.97	44.14
60 +	6.19	6.28	5.27	4.75	6.76	6.13	5.87	6.00

Economic Subsystem

The simulated behaviour of the economic subsystem indicates it undergoes the type of structural changes that we would expect in any developing economy like India. The share of the primary sector declines continuously from 52.1 percent to 47.9 percent and that of the manufacturing steadily increases from 30.2 percent to 33.4 percent. One would have expected much radical structural change,but judging from the past performance of the manufacturing sector in real terms vis-a-vis the primary sector it appears quite realistic. Similarly the share of consumption of food in total private consumption shows a decline from 64 percent to 60 percent. The share of services in total consumption increases from 16.3 percent to 19.6 percent in contrast to manufacturing that changes from 19.7 percent to 20.0 percent during the period.

Most of the macro variables like gross domestic product, private/ government investment and consumption grow on an average at just over 3% per annum at constant prices. This is quite reasonable and a likely long term growth rate for the next thirty years in the Indian context. Exports that have been growing at 5.4% in the first twenty six years of India's planned development, are seen to grow on average at 6.6% in the thirty years under study. The rate of growth of imports, in physical terms,

is seen to marginally decline from the long-term average of 3.6% between 1950 and 1976 to 2.2% during 1971-2001. Near self-sufficiency in food since the late 1960s and a growing level of sophistication in manufactures support these results.

With the increase in the labour force from 136.8 million to 271.1 million in the rural sector and 35.9 million to 106.5 million for the urban sector during the thirty years, the unemployment rates double in rural areas from 8.9% to 18.1% and grows from 6.2% to 8.1% in urban areas. This is due to the fact that urban employment is growing faster due to the favourable impact of the growth of manufacturing and service sectors. Technological changes, productivity gains and the growing population tend to worsen the unemployment problem which the model reveals as the major source of instability in society in future.

Income Distribution Subsystem

The rural per capita income significantly improves relative to urban per capita income. The rural income per adult equivalent is only about 53% of the corresponding figure for urban in the base year but it has improved to 69% in the final year. This result is not surprising as the rate of growth of population in the urban areas is faster than in the rural area due to considerable migration. This, coupled with the model's assumption of a static distribution of value added in each sector between rural and urban locations is bound to reduce the inequalities in the computed rural and urban per capita incomes. However, the significantly higher growth rates of the urban-oriented sectors over the predominantly rural sectors act as an accelerating factor for these inequalities.

The share of wages in GDP also improves marginally. The average earnings of employees and employers in rural areas increase by about 15% during the thirty year period. The corresponding figures for urban register marginal improvement during the first twenty years (10 percent for employees and 5 percent for employers) and decline thereafter. (These results may partly be due to the static distribution of value added coupled with the rural to urban migration, and indicate the need for an alternate formulation)

The overall income distribution in real terms does not significantly change during the simulation period in this model. This is as expected for the income-distribution module is of very limited sensitivity: The lowest 20 percent and 40 percent of the population accounts for only 4.2% and 14.1% of total income in the base period and their shares improve only marginally to 4.4% and 14.7% respectively towards the end of the simulation period. In fact, this indicates a continuation of the real-world trends; the income inequality during the last three decades has been estimated to remain same or marginally increased*.

Basic Needs Subsystem

There is a remarkable increase in life expectancy during the period. The illiteracy rate goes down from 70% in the base period to 62.3% in the final year. The primary and secondary school enrolments increase from 70% and 20.5% in the base period to 80% and 32.7% respectively. Thus, it appears that even when the economy is growing very slowly the educational variables are showing much improvement. This is due to the increasing private and government expenditure on education.

Though the per capita income increases only by 37%, the per capita private consumption expenditure on basic needs other than food goes up by 62% from Rs 15.4 in the base period to Rs 24.7 in the final year. Thus some of the basic needs of the population are increasingly satisfied with a rising per capita income. However, in the absence of data covering the different segments of the population, the attempt was not made in this model to capture their levels of satisfaction of basic needs.

The percentage of pucca houses to total houses improves from 57.3 in the base period to 66.4 in the final year. Caloric consumption per capita goes up from 1985 to 2255. However, the possibility of substituting for the fuel-wood energy used in the household sector by commercial energy appear to be extremely dim as the commercial energy availability index remains more or less the same throughout the period.

---

* Rudra, A., (op cit) page 21.

Overall

The general scenario of Indian economy by 2001 A.D. appears not to be very bright and suggests the need to work out alternatives. The rate of growth of the economy will be very slow (real per capita income will be growing at a rate of about 1.1% per year) and hence the rate of transition of the economy (from agriculture-based) to an industrial one, and the kind of structural transformations associated with this will be extremely slow. Moreover, with significant improvement in health, education, etc. (which will nevertheless take place) the labour supply is growing much faster than the demand for labour with the result that the rural unemployment rate is bound to reach some staggering figures (18% in the model by the turn of the century compared to the 1970-71 figure of 8.8%). This is mainly due to low capital formation coupled with rising labour productivity. Though the balance of payments appears to be becoming more and more favourable, it need not be so in reality as the import prices are growing and may well be expected to grow much faster than the export prices (this is not covered in the model). Increasingly unfavourable terms of trade could also be due to the abnormal changes in oil and petroleum products prices.

3.3 Policy Alternatives: Experiments with select variant scenarios

The prime advantage of building a computer simulation model of an economy is that one may examine the effects of alternative values of policy variables and select those feasible policy options that result in the most desirable (or least undesirable) scenarios.

The distinguishing feature of constructing policy analysis models, is to examine the relative impact of different policies on output variables. The emphasis now is not on the absolute predictability of the output variables of the model but rather on the analysis of differences in relative values of concerned output variables resulting from the choice of, or combination of, policy variables. These policy analytical simulation models could be described as 'laboratories' where policy experiments could be conducted to test the effects of a variety of scenarios the policy maker wishes to have.

In the following pages a few such policy experiments have been described, primarily to demonstrate the utility of building computer-based policy analysis models. In particular to examine (a) the possibility of selecting a preferred strategy for India given certain global scenarios, (b) the degree of influence of variables that describe a satisfaction of basic needs on overall performance of the national economy.

The future of most of the national economies, particularly of those in the developing world - the South - will be influenced by global future alternatives. The current debate on the establishment of the New International Economic Order and the subsequent North-South dialogue on trade lead to several global scenario-building exercises. The working group on the ILO part of the UN FUNDPOP project* had decided that all the country projects sponsored by the ILO would examine two different types of external scenarios for the period 1980-2000. The two global scenarios are referred to as G1: Easy access of countries in the South to markets in the North and increase in exports of consumer goods in the sectors food, agriculture, textiles and light industry, and G2: North introduces strong protective measures against imports from South requiring diversification of exports to Southern countries, more exports of capital goods and less of consumer goods. In the case of India the concerned sectors are Heavy Industry and Chemicals.

Any country in the South could respond to these two scenarios in one of the following three ways, R_1, R_2 and a combination R_1R_2.

R_1: Increase the exports as far as possible and place emphasis on the development of Human Skills and greater provision for Basic Needs. It consists of any combination of the following four policy options.

(i) Increase Government expenditure on Basic Needs

(ii) Minimise imports selectively

  (a) minimize imports in all sectors

  (b) minimize imports in consumer goods

  (c) minimize imports in capital goods sector

---

* Economic and Social Policy Synthesis Branch, Employment and Development Department, ILO, Geneva.

(iii) Favourable internal terms of trade for Agriculture

(iv) Tax revenue increase.

R_2: The second policy response is promotion of exports combined with import liberalisation policy. It consists of three specific policy options, namely,

(i) increased expenditure on education

(ii) no imports control

(iii) worsening of internal terms of trade for Agriculture.

R_1R_2: Combination of R_1 and R_2 policies such that in the first decade R_1 policies are adopted and in the latter decade R_2 policies.

Table 2 gives the six possible group of strategies. Taking into account the three sub alternatives available under policy two in R_1, a large number of combinations are possible. These are spelt out fully in Appendix E. After trying out a number of such combinations, four strategies - one from the each group - were selected. These were found to be both logically consistant and most effective. These are:

Strategy 1: (a) North-oriented export expansion of consumer goods. The rate of growth of exports in selected sectors for first fifteen years and next fifteen years are given in Appendix F. Imports are progressively reduced by 3 percent in all sectors except energy throughout the period.

(b) Increased investment in Basic Needs: both private and public investments in basic needs sectorare increased by 10 percent per year (for the first 10 years only).

(c) Favourable terms of trade for agriculture: "Corporate tax" is reduced to zero in the sector Agriculture.

Strategy 2: (a) South-oriented exports expansion of capital goods sectors, Heavy Industry and Chemicals. The rate of growth of individual sectors for the first fifteen and latter fifteen years is given in Appendix F

Table 2: India's Responses through select strategies for global scenarios

Global Scenarios \ India's Response	R_1 Emphasis on the Development of Minimum Skill and provision of B.N. (i), (ii), (iii), & (iv)	R_2 Promotion of Combination of Export Expansion and Import liberalisation (i), (ii),(iii)	R_1R_2
G1: Easy access of countries in South to markets in North (therefore increase in exports of comsumer goods)	Strategy I (a) North-oriented consumer goods exports (b) Minimizing imports (c) Increase BN expenditure (d) Favourable internal terms of trade for Agriculture	Strategy III (a) North-oriented consumer goods (b) No imports restrictions (c) Increase in BN expenditure	Strategy V Strategy I for first 15 years followd by Strategy III for the remaining period.
G2: North introduces strong protective measures against Southern imports (therefore diversification of exports to other Southern countries: More capital goods & less consumer goods.)	Strategy II (a) South-oriented capital goods exports (b) Minimizing Imports (c) Increased BN expenditure (d) Favourable terms of trade for Agriculture.	Strategy IV (a) South-oriented capital goods exports (b) No imports restrictions (c) Increase in BN expenditure	Strategy VI Strategy II for first 15 years followed by strategy IV for the remaining period.

(b) Minimization of import in all sectors as under Strategy 1.
(c) Favourable terms of trade as under Strategy 1.
(d) Increased expenditure under basic needs as under Strategy 1.

Strategy 3: (a) North-oriented exports expansion with emphasis on consumer goods sectors. The growth rates are same as in Strategy 1.
(b) No imports restriction, imports are determined by the model.
(c) Investment on basic needs as in previous strategies.

Strategy 4: (a) South oriented exports of capital goods. The growth rates of concerned sectors are same as for Strategy 2.
(b) No imports restrictions
(c) Additional expenditure on basic needs as in other three strategies.

The four scenarios of the Indian economy out to the year 2000 (as compared with the base run scenario) that emerge through the choice of the four different strategies, are as follows: (See also Table 3.)

Scenario S1

The scenario of India 2001 with the adoption of Strategy 1, does not significantly alter the demographic scene; the positive or negative changes in most of the demographic variables are well within 2 percent. Female life expectancy, however, as a result of increased expenditure on basic needs has gone up by 3 percent. Rural to urban migration also increases by 5 percent mostly because the mean wage pay in urban areas has gone up in contrast to that in rural.

In the economic scene, however, significant changes do occur, with exports up by 71.5 percent and imports down by 62.2 percent due to the export expansion and import minimization policy. The GDP goes up by 43.1% compared to the corresponding figure in the base run. The initiative for this growth apparently comes from the private sector which increases its investment by 113% as compared to government investment that increases only by 40%. The lower government investment rate could well be assigned to the fact that government tax revenue only increases by 44% in Strategy 1.

Though the consumer goods sectors viz. food, other agriculture, textiles and light industries get a favourable climate for exports, the

Table 3: A comparision of selected variables under Base Run and the four select Strategies in 2000-01

Selected Variables	Base Run	Select Strategies S1	S2	S3	S4
1	2	3	4	5	6
Demographic Variables					
1. Total population (Million)	979.5	980.7	980.0	979.5	979.3
2. Share of urban population (%)	26.8	27.2	27.4	27.1	27.2
3. Share of population under 15 (%)	34.7	34.5	34.5	34.5	34.6
4. Fertility rate (per 1000)	124.3	121.3	121.9	121.9	122.5
5. Female labour force participation rate	30.5	29.8	30.1	30.4	30.4
Economic Variables					
1. Total private investment (Rs Mill.)	82700	175803	149298	135213	117590
2. Total government " (" ")	45650	63822	58554	57104	53544
3. Govt. tax revenue (" ")	99600	143163	129800	127913	118862
4. Private consumption (" ")	659075	849664	791184	784216	742675
5. Govt. consumption (" ")	58585	78660	73092	71302	67178
6. Total exports (" ")	45502	78155	61045	100766	102979
7. Total imports (" ")	28995	10971	12850	38303	58099
8. Gross domestic product (" ")	842700	1206072	1092937	1080640	1002770
9. Agricultural output (" ")	403740	550797	498007	502491	459281
10. Manufacturing output (" ")	277736	429776	388441	377446	354969

Contd.....

1	2	3	4	5	6
11. Rural employment (Million)	222	225.7	215.7	238.3	232.9
12. Urban employment (")	97	101.0	99.8	102.4	102.0
13. Mean wage pay - rural (Rs)	1232	1832	1677	1573	1436
14. Mean wage pay - urban (Rs)	3458	5285	4832	4438	4181
15. Rural unemployment rate (%)	18.1	15.9	19.6	11.8	13.6
16. Urban unemployment rate (%)	8.1	6.3	8.1	4.9	5.8
Basic Needs Variables					
1. Female life expectancy (years)	63.7	65.8	65.2	65.3	64.8
2. Per capita calorie intake	2225	3326	2972	2946	2701
3. Primary school enrolment rate (%)	81.4	81.5	82.1	81.3	81.6
4. Secondary " " (%)	33.2	35.5	35.0	34.8	34.4
5. Share of pucca houses (%)	61.2	74.1	69.9	68.6	66.1
6. Share of Ag. labour force (%)	65.6	64.8	64.4	65.4	65.2

output of the first two sectors is up only by 36 percent compared to 55 percent by manufacturing sector (consisting of textiles, chemicals, light and heavy industries, construction and energy) and 40 percent by services and basic needs. This result is mainly due to the interdependence of various sectors. The impact of economic policies is favourable on employment. For, both rural and urban un-employment rates decline by 11.9% and 22.6% respectively. Income inequalities remain unaltered.

Most of the basic needs variables show significant improvement. In fact, the private per capita expenditure on basic needs is up by 45 percent mainly due to the rise in per capita income. As mentioned earlier life expectancy rises by 3.2 percent. Though the primary school enrolment remains the same, the enrolment in secondary schools increases by 7 percent. The calorie consumption increases by 50 percent, and, consequent on the policy of increased basic needs expenditure, the yearly addition to labour productivity due to increased basic needs satisfaction increases by a factor of four over the base run.

Scenario S2

The demographic scene is more or less same as the preceding one, with a marginal increase in migration rates (6.7%).

The adoption of Strategy II that suggests increase in exports of capital goods (heavy industry and chemicals) to Southern countries, does not appear to boost up exports as much as in S1 for they register an increase of only 34 percent. The decline in imports is also less, namely, 56 percent. The GDP has risen by just 30 percent which is significantly less than that obtained under Strategy I". As can be seen from table 3 all the macro-economic variables under this strategy have lower values compared to the corresponding figures under Strategy 1 (S1).

The strategy of increased exports of capital goods to the South, as expected, does not have a favourable influence on employment generation. The rural unemployment rates increase by 8.4 percent and the urban rate declines marginally by 0.6 percent (the increase in employment being provided by the service sector). Again, as anticipated, the share ofthe lowest 20 percent of the population shows a marginal decline of 3 percent.

The Basic Needs scene again improves under Strategy II but not as much as under Strategy I. Thus the calorie consumption increases by 33.6 percent, secondary school enrolment by 5.5 percent, percentage of pucca houses by nearly 14.3 percent, etc. Consequently, the yearly increment in labour productivity is in 2000/nearly twice what it is in the base run, but lower than in S1.

Scenario S3

The demographic scene, as before, does not show any significant changes. The relaxation on import restrictions in contrast to S1 and S2 apparently does the trick as exports in the terminal year show a 121% increase from the base run figure. The imports this time increase by 32.1 percent. The impact on overall growth as reflected in the GDP, is, however, not very spectacular, the GDP being only 28 percent higher than in the base run. The private and government investment are up by 63.5% and 25% respectively. The private and government consumption figures show an almost equal rate of increase, namely, 19.1 percent and 21.7 percent. Once again, due to spurt in labour-intensive sectors, namely, agriculture, food, textiles and light industry, the unemployment rates, both in rural and urban areas, register a sharp fall from the Base Run figures of 34.5 percent and 40.3 percent respectively. The total population being same, the per capita income shows an increase equal to that in GDP. An interesting feature of this scenario is that the increase in mean wage pay in the rural sector is almost the same as that of the increase in urban mean wage pay (28.4%). While the overall income inequality shows an insignificant increase of 1.1 percent, the position of the lowest 20 percent and 40 percent of the population in terms of their income marginally deteriorates.

The Basic Needs scene under Scenario S3 also reveals an improvement in the quality of life. This is reflected in increase in female life expectancy by 2.3 percent and calorie consumption by 32.4 percent, and a slight reduction in illiteracy rate by 0.9 percent. The annual increment in labour productivity goes up by four times over the base run.

Scenario S4

Leaving aside the unaltered demographic scene, one finds that the joint influence of liberalization of imports and restrictions with exports of

capital goods to Southern countries, brings about a buoyancy in exports. They register a highest ever increase of 126%. However, the imports shoot up by 100% too. But the GDP is up only by 19 percent. This is reflected in private and government investment levels that increase only by 42.2 percent and 19.3 percent respectively. The corresponding consumption figures also show modest increase of 12.7 percent and 14.7 percent respectively. However, unlike Scenario 2, the unemployment rates do decline by 25 percent for rural and 29 percent for urban areas respectively. The increased exports permit the economy to operate at a higher capacity utilisation and therefore at a lower unemployment rate.

With an increase of mean wage pay of 21% in the urban areas and only 16.6% in the rural sector, the differences in rural and urban earnings widen. The income inequality marginally increases.

The satisfaction of Basic Needs under this scenario is not very high. The female life expectancy increases only by 1.6 percent, calorie consumption by 21.4 percent, education enrolment by 1.1 percent. However, the percent improvement in annual increment to labour productivity is still high (243%).

3.4 Comparative Analysis of the Four Strategies

The main distinguishing features of the four strategies are that S1 and S3 in response to Global Scenario G1, suggest export of consumer goods to North with increased expenditure on basic needs. What makes them different from one another is that S1 includes favourable internal terms of trade to agriculture and minimization of imports, while S3 relaxes the import restriction. Similarly, S2 and S4, in response to Global Scenario G2, promote exports of capital goods to Southern countries coupled with increased expenditure on basic needs. Once again S2 and S4 differ with respect to import policy, and internal terms of trade.

None of the four strategies have a population policy that directly affects the demographic sub-system. The indirect effect on demographic subsystem through feedbacks from economic and basic needs subsystem is extremely weak. This is likely due to conflicting influence of increased expenditure on basic needs.

Economic Subsystem

The relative impacts of the four strategies become distinguishable with

respect to economic subsystem outputs. It is evident from Chart 1 that liberalisation of imports has a strong favourable impact on the volume of exports since they are quite high under adoption of strategies S4 and S3. The closeness of S3 and S4 also implies that the global scenarios G1 and G2 really need not affect India's export performance, provided the country adopts the Appropriate Response strategy. S1 and S2 are not the preferred strategies as far as exports maximisation is concerned.

In terms of per capita income or GDP S1 followed by S2, are better strategies (see Chart 4).*

Increase in private investment is highest under S1 (113%) and least under S4 (42%). The percentage increase in private and government consumption also follows the same order, i.e. maximum under S1 and minimum under S4. Once again the impact of global scenario, be it, G1 or G2 has little influence on the investment responsiveness. Indian economy has historically had a relatively small foreign trade sector.

From the point of view of employment creation, Strategy S3 is best with rural and urban unemployment rates falling by 34.5% and 40.3% respectively. This is followed by Strategy S4 with corresponding figures 24.8% and 26.6% (Charts 4 and 5). In contrast, Strategy S2 leads to a 8.4% increase in rural unemployment rate.

In terms of mean wage pay for the rural sector Strategy S1 is optimal and S4 is the worst. This is so because S1 has focussed on exports from relatively labour intensive industry and the agricultural sector has favourable internal terms of trade. S4 in contrast has emphasis on capital intensive exports, import liberalization (that keeps domestic investments low) and relatively adverse internal terms of trade.

Basic Needs Subsystem

Coming to the basic needs subsystem, the increase in private per capita consumption of Basic Needs is maximum under S1 (44.9 percent), more or less same (35 percent) under S2 and S3 and least under S4 (23.6 percent). Again the order preference of Strategy is same with respect to increase in the

---

* It is interesting to note that the per capita income under S3 converges to that of S2 in the terminal year (see also the last section).

availability of pucca houses, 21.1 percent under S1, and 8.1 percent under S4 and also for other basic needs variables like calorie intake, secondary school enrolment, etc. The net impact on female life expectancy, under the four strategies (Chart 10) is not significantly different from one another.

3.5 A Note on the General Strategy

As the foregone analysis show there does not exist an "all-best" strategy for India to respond to the two global scenarios. Different strategies are good for maximisation of different development goals. To arrive at a single optimal strategy one would have to strike a balance by giving due weights to different development targets. However, the above analysis indicates that Strategy S1 appears to be a preferred strategy if one takes several of the domestic development goals into account. And if one works from global point of view to the maximisation of world trade, strategy S4 is most suitable.

An important result of these experiments is that an increase in per capita income, per se, is insufficient to bring any significant reduction in the growth of population. Moreover, most of the basic needs variables like life expectancy, literacy rates, etc. do not significantly respond to the changes in the economic system.

A few preliminary experimental simulations (the results of which are not presented here) suggest that both G1 and G2 scenarios considerably improve if along with R_1 and/or R_2 a simultaneous strategy to reduce fertility rate is also pursued. The result is still better if there is a corresponding reduction in illiteracy also. Some initial results point towards an optimum strategy which consists of increased investment in basic needs coupled with a reduction in fertility and illiteracy rates under either G1 or G2 scenario.

It is interesting to note that many of the output variables under strategy 3 converges to the corresponding figures under strategy 2 at the end of the simulation period. This is due to the fact that though these variables grow relatively faster under strategy 2 than strategy 3 in the initial years, it gets reversed subsequently. The implications of such findings could be far reaching. For example, it shows that a country today pursuing a North-oriented export policy could achieve the same growth rate over a period of time even under a South oriented export policy with appropriate strategies. This points towards the wide options available to planners and policy makers in selecting long run development strategies.

As stated earlier, one of the basic objectives of this study has been to demonstrate the need and utility of building policy analysis country models. It can be said without hesitation that this exercise has been to a considerable extent successful in this respect despite the fact that it is first of its kind in India and that the present version of the model has serious limitations and simplifying assumptions. It provides a ready interactive mechanism for a policy maker to analyse the impact of a single or a set of policy changes on the output of the economy over a period of time and to examine the relative merits and demerits of different policies and strategies.

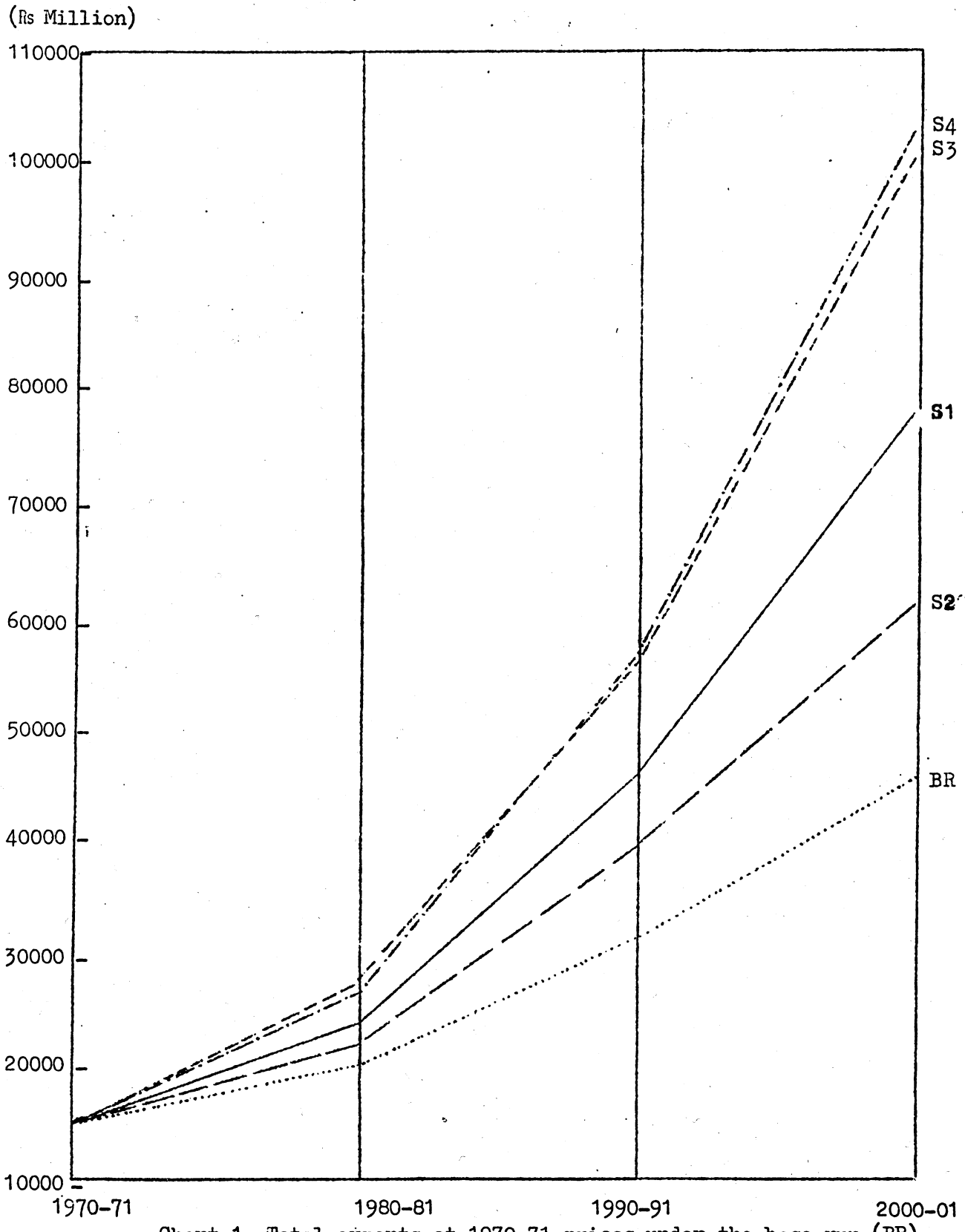


Chart 1 Total exports at 1970-71 prices under the base run (BR) and four strategies.

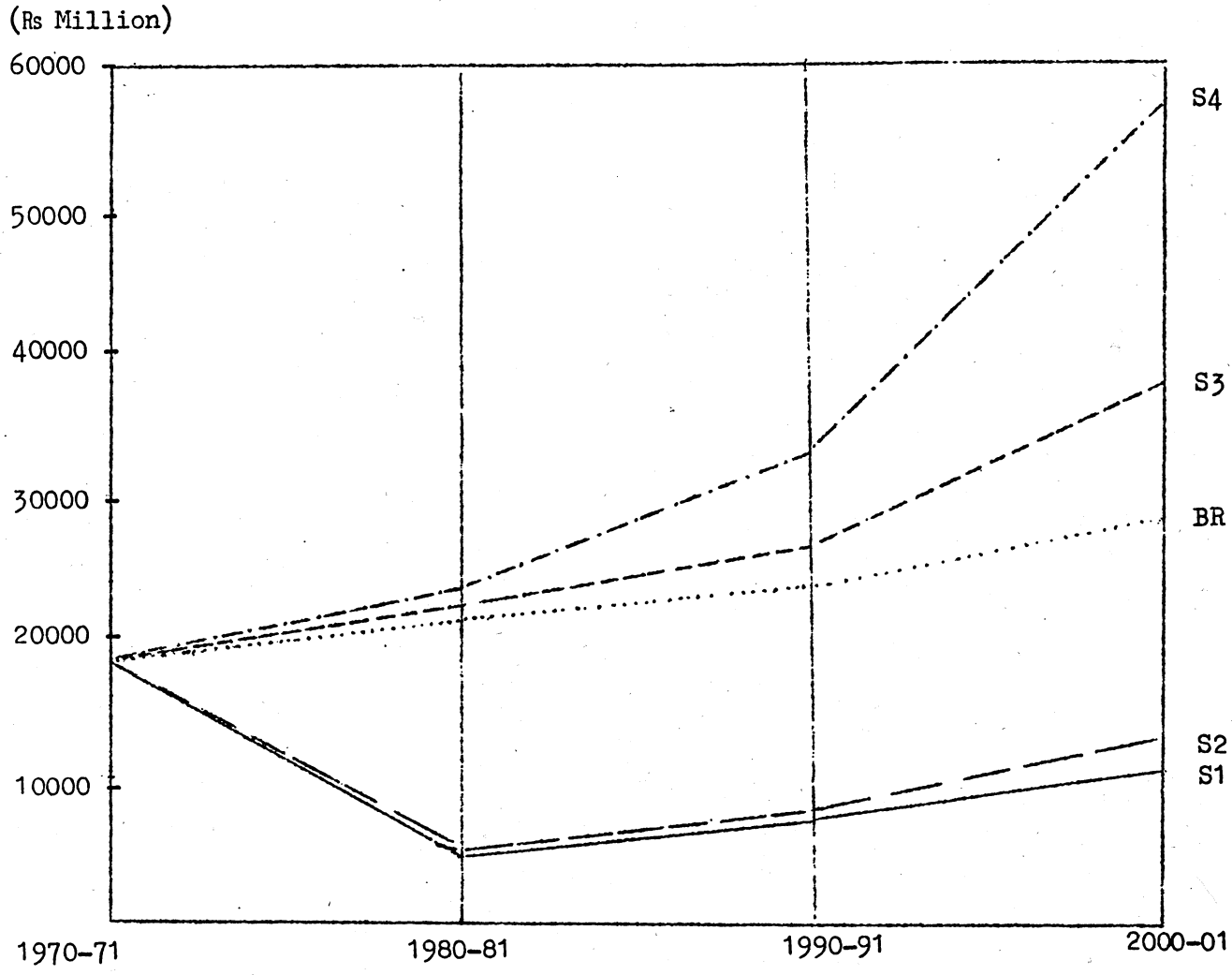


Chart 2 Total imports at 1970-71 prices under the base run (BR) and four strategies.

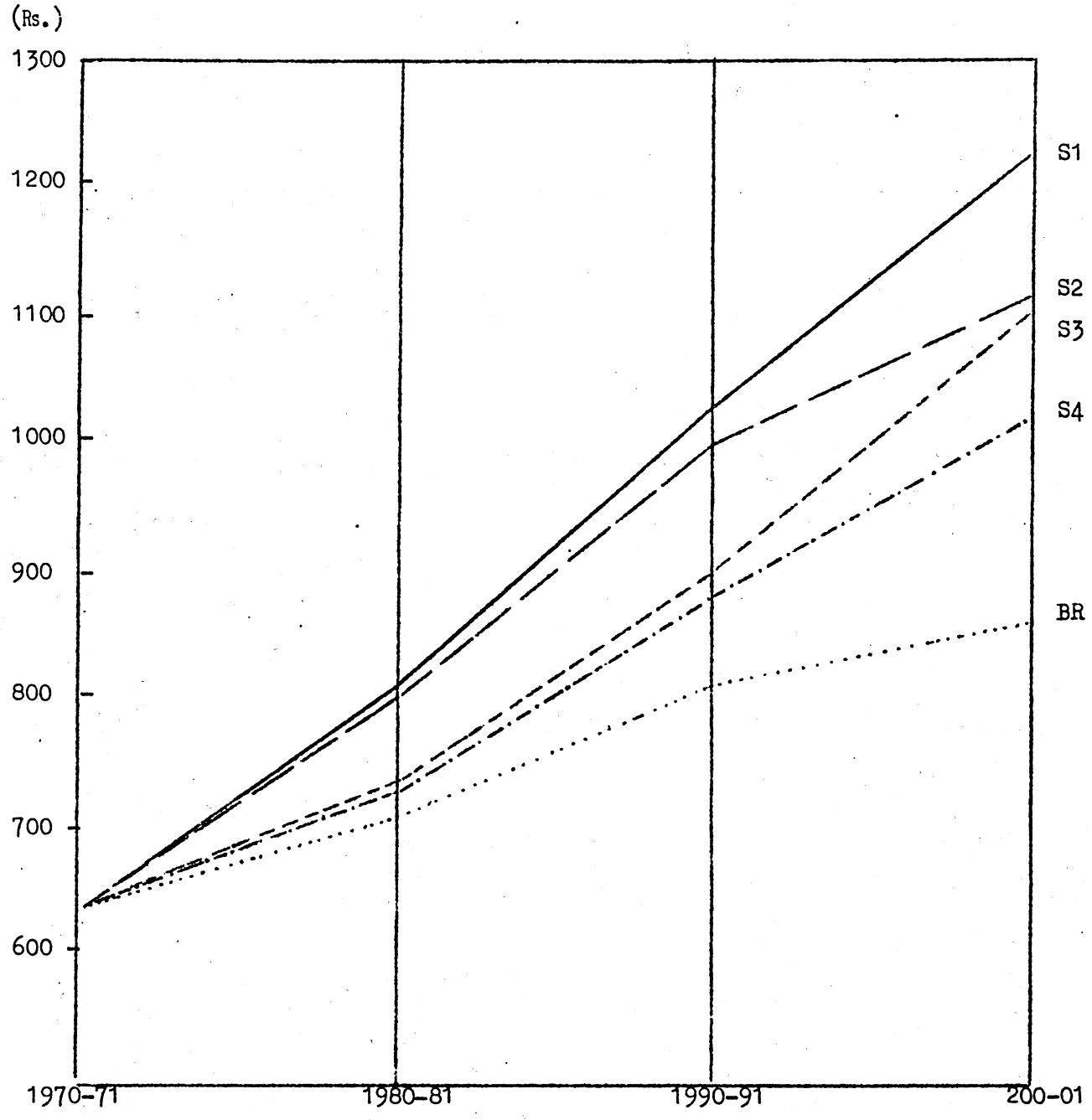


Chart 3 Per capita income of 1970-71 prices under the base run (BR) and four strategies.

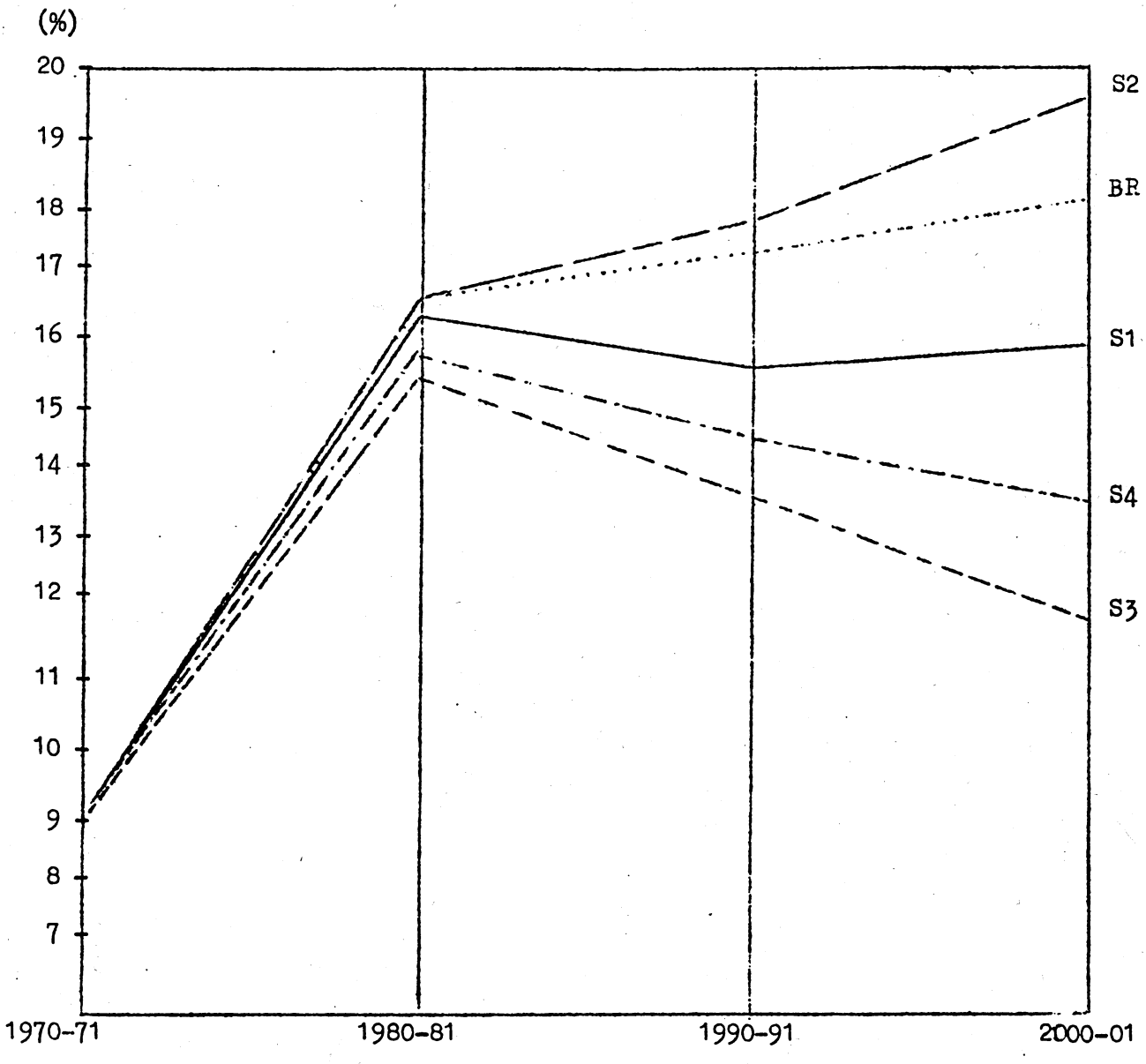


Chart 4 Rural unemployment rates under the base run (BR) and four strategies.

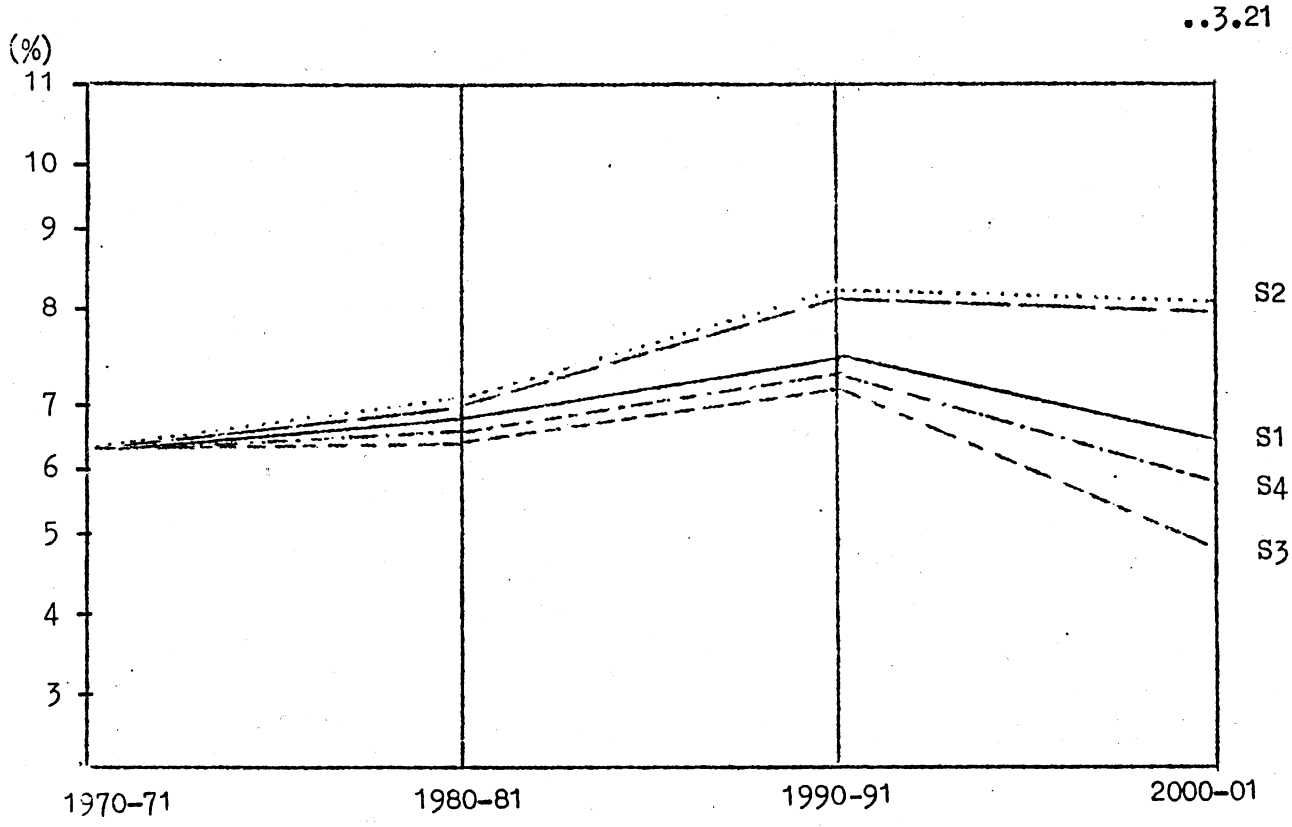


Chart 5 Urban unemployment rates under the base run (BR) and four strategies.

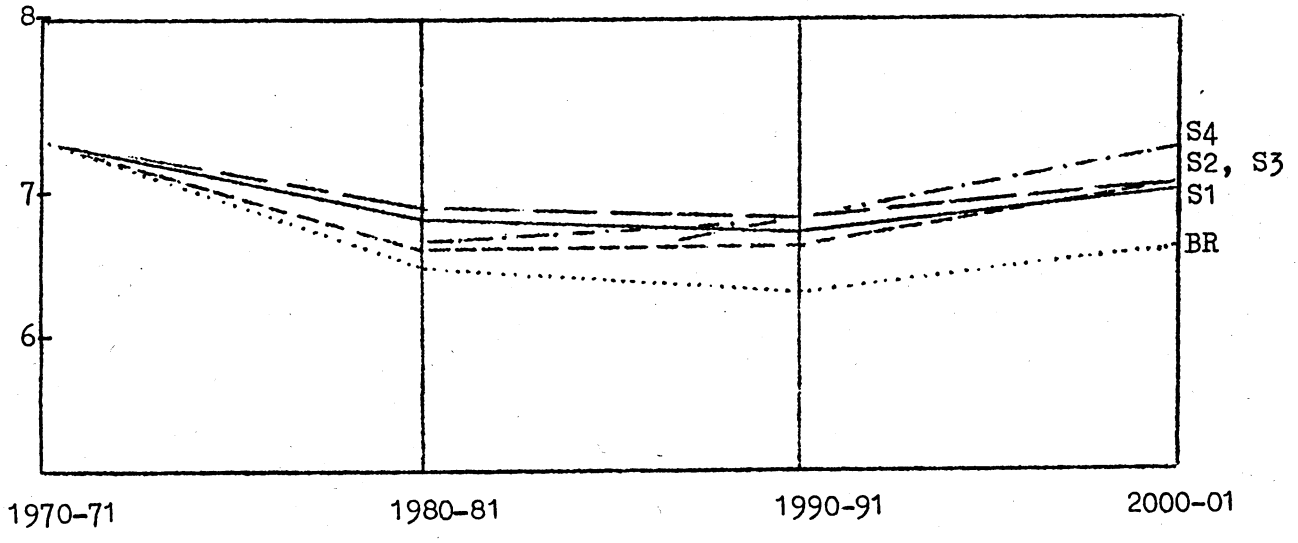


Chart 6 Migration propensity under the base run (BR) and four strategies.

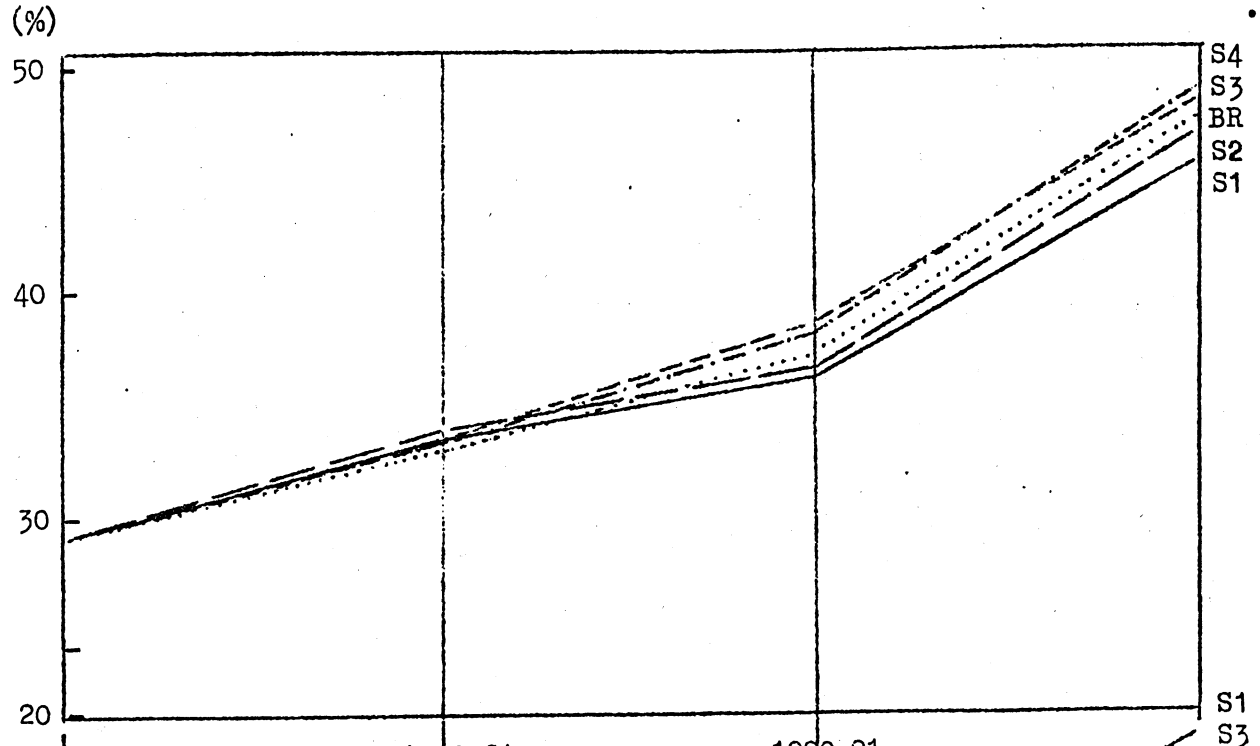


Chart 7 Percentage of literate population under the base run (BR) and four strategies.

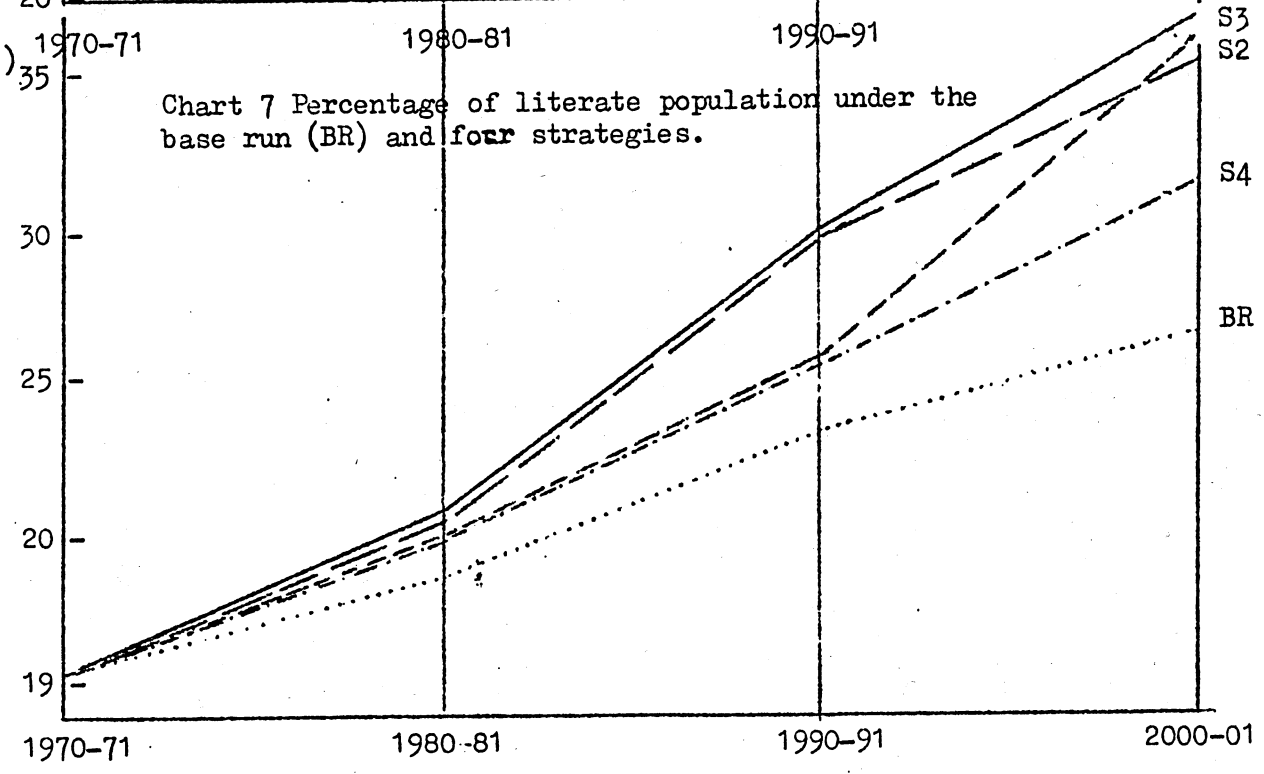


Chart 8 Per capita private expenditure on Basic Needs under the base run (BR) and four strategies.

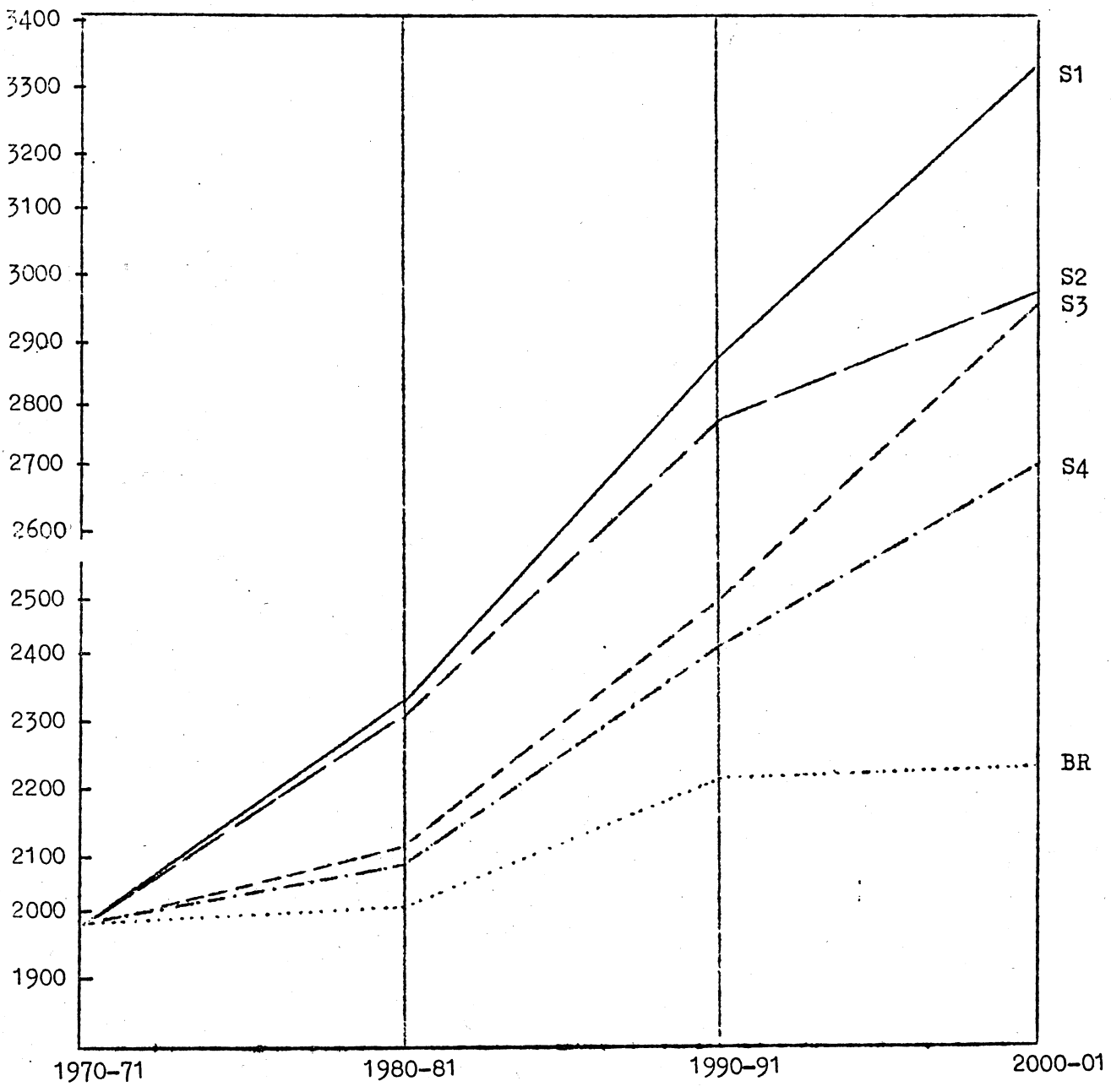


Chart 9 Per capita calorie intake under the base run (BR) and four strategies.

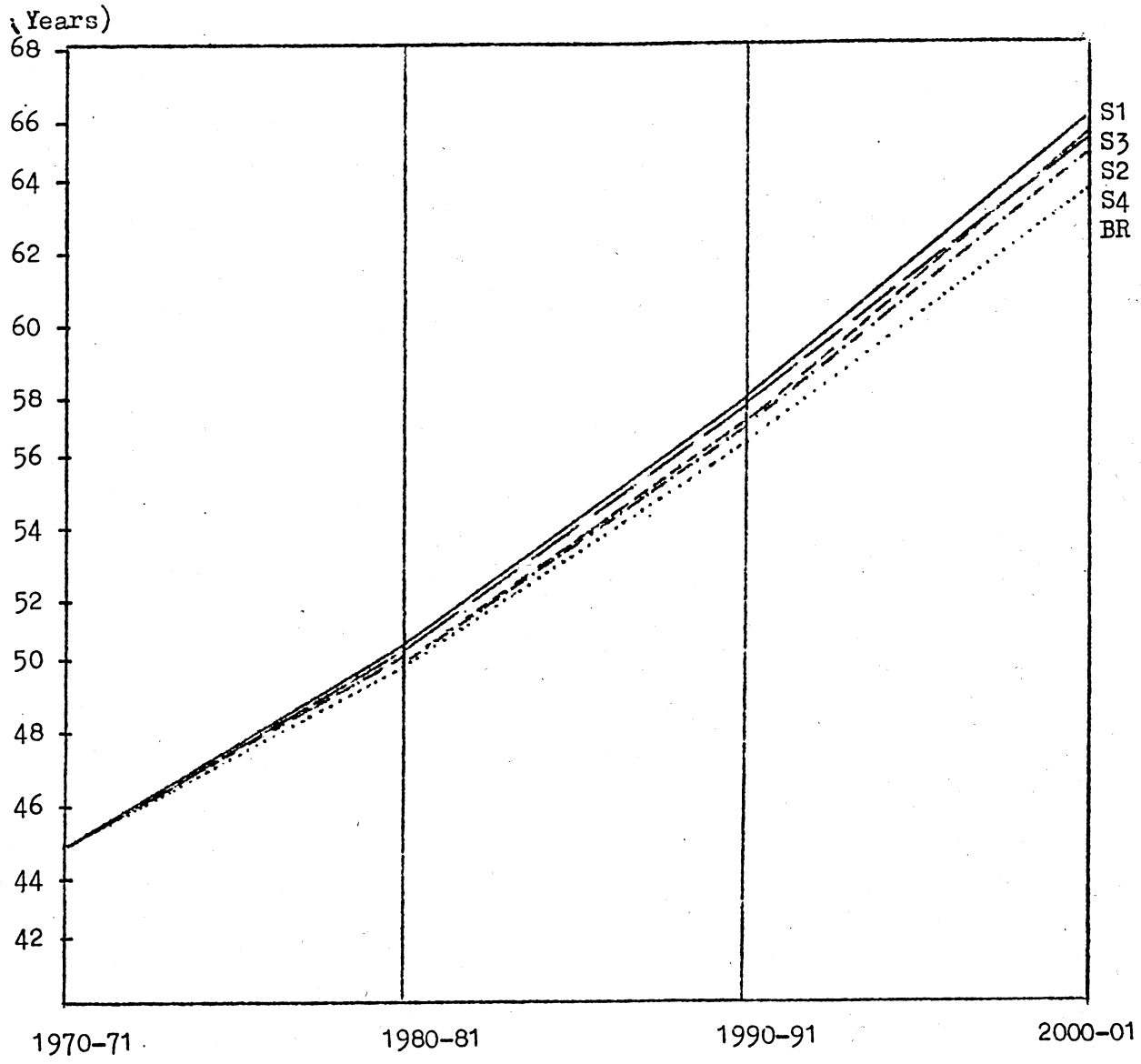


Chart 10 Female life expectancy at birth under the base run (BR) and four strategies.

CHAPTER 4

FUTURE DEVELOPMENT OF THE MODEL

No modelling group can claim to have built a good model in one stroke nor can one remain satisfied without making efforts for improvements. Our model is no exception. When constructing a model one has to make a number of simplifying assumptions. These must be modified step by step to get a picture closer to the reality. In addition, some of the shortfalls or limitations of a model come to be known only after it has been operated. In this Chapter, therefore, we shall list a number of possibilities - the lines on which further work needs to be done.

4.1 Disaggregation of Basic Needs Module

In the present version most of the basic needs variables are specified at the aggregate level. For example, per capita calorie consumption refers to the overall average calorie intake per person in the economy. Obviously this alone is not a very satisfactory measure especially in the context of a concern for satisfaction of the basic needs of the poorest. An increase in the average per capita calorie intake, per se, at least in the initial stages, need not necessarily mean an improvement in the nutritional intake of the lower strata of the population. But it is precisely this target group about whom we are concerned. Hence along with the improvement in the basic needs satisfaction at the aggregate level we also have to examine that of the specific target groups. This requires the distributional aspects to be specified explicitly.

This is also true for education and housing. In the present version of the model only three educational variables are specified: overall literacy rate, overall primary school enrolment rate and overall secondary school enrolment rate. However, in order to evaluate alternative policy options effectively one ought to consider the literacy rates of males and females in rural and urban areas separately. Instead of estimating an overall enrolment rate, separate enrolment rates of boys and girls for primary, middle and high school with proper lags should be estimated. Housing too should be disaggregated for rural and urban areas. Education among girls could be isolated as a key BN policy

variable for it would affect the future health, family planning and child care of families. The postponment of their age of marriage through availability of job opportunities and thereby influencing the fertility rate, needs also to be structured.

The basic idea behind the disaggregated analysis as detailed above is to bring out the fact that policies, aimed at improving the basic needs satisfaction of the people, may be quite effective at the aggregate level but need not be so for specific target groups. This disaggregation is also helpful in checking for the consistencies of certain policies. For example policies aimed at increasing the primary school enrolment rates should also take into account the future additional demand which would be generated for middle and higher secondary school enrolment. Or conversely, attempts to increase enrolment at higher levels of schooling require first the improvement of enrolment/completion rate at lower levels.

Most basic needs expenditures are met jointly by government and private sources, though in varying proportions. For example calorie consumption is met largely through private expenditure whereas the basic health facilities are heavily subsidised by government. Private direct cost of education at the lower levels is very low though it increases considerably with higher levels of education. Government expenditure on education is quite high at all levels of education. Policies related to the composition of private and government expenditure over a period of time can be studied to assess the quantum of government efforts - and the period of time - required to attain given targets of selected basic needs. For example the government might increase its expenditure on selected basic needs for a given period of time or until a particular target of that basic need is achieved and then can terminate or slowly withdraw the additional expenditure if the corresponding private expenditure can sustain it. The basic idea here is to explore to what extent additional government expenditure over and above the normal expenditure is necessary to improve selected basic needs satisfaction before private expenditure can take over.

4.2 Establish more Linkages between the Basic Needs Subsystem and the Economic and Demographic Subsystems

At present linkages between the basic needs subsystem and other subsystems exist, but they are rather weak. This could be due either to the weakness inherent in the systems themselves (and revealed by the statistical estimation technique used) or to improper specifications of the concerned relationships. In India the growth rate of basic needs satisfaction of the poor has not been impressive enough to be reflected in the macro-statistics that describe the economy. In fact this is a major concern of the policy makers who would like therefore, to redefine 'poverty' more operationally. Nevertheless there must be some impact on the other subsystems which ought to be reflected in our model. For example one would like to study the effects of changing composition of employment (locational as well as sectorwise) on the nutrition levels in terms of, say, calorie consumption of specific target groups. Clearly this is an area with considerable scope for further research.

4.3 Manpower Subsystem to be developed

We need a separate module in which to relate the need for different skills and their supply. The informal sector will then also be brought in at least at an aggregate level.

Disaggregation of Labour Force Participation Rates

Presently, to estimate the labour supply, only the overall female labour force participation rate is assumed to vary while the male labour force participation rate is assumed to be constant. This is not realistic and it is desirable to estimate male and female labour force participation rates for rural and urban populations separately. In fact this ought to be estimated for specific age groups (for example 0-14, 15-24, 25-59, and 60+) if we are to analyse the effects of various educational and economic policies on labour supply and employment.

Educational policies related to the expansion of enrolment rates at various levels of education might bring down the child labour force participation rates. Similarly policies related to increasing the share of non-agricultural output might again reduce the labour force participation rate in the rural areas. One would expect a priori that the

combined effects of such policies would be better than the sum of their individual effects. The detailed analysis of such policies requires a very broad specification of the labour supply subsystem in terms of sex, location (rural and urban) and age groups.

Classification of Labour Force According to Skills and Introduction of Wage Rates

The present version of the model treats the labour force as homogeneous. The division of labour force into various skills is preferable however, especially in the context of the economy being divided into a number of sectors. Since economic development requires, and also to some extent results in the improvement of the quality of labour, such disaggregation of labour force can be very useful in the analysis of manpower planning especially if it is linked to the educational variables. For example an analysis of this kind would give the type of education to be pursued and the related time-lag corresponding to the proposed expansion of any particular sector.

It is also required to specify the wage equations endogenously. However, it should be noted that wages, in general, are sticky downwards and hence the behavioural equations may not be reversible. However, an under-employment equillibrium can be obtained in the labour market with sticky wage rates. Such specifications will also be very realistic in exploring the coexistence of higher wage rates and high unemployment rates in certain sectors of the economy.

4.4 Introduction of prices in the Model

The present version of the model does not take into account changes in prices. Relative changes in the sectoral prices can be very significant and prices play an important role in the distribution of income. In fact a dual pricing system can be tested in some sectors like food, agriculture, transport and communication where there exists a market price as well as government controlled price for many commodities. Some of these market prices can be endogenised whereas the controlled prices can be treated as exogenous. It might be quite useful to analyse the short and long term effects of such market regulation by public agencies not only on production and employment of related sectors but

also upon the other sectors and on income distribution, etc.

The explicit introduction of prices in the model has other advantages too. It can throw considerable light on the magnitude of the problems created by steady and continuous price rises in key commodities such as petroleum and petroleum products. Scenarios corresponding to extreme price rises - moderate to two digit growth rate of prices - are very useful in analysing and developing long term strategies of development. Such analysis might considerably alter the rankings of current projects based on economic and social benefit-cost analysis if likely future changes of input and output prices are duly considered.

An urgent need is to be able to analyse changes in the economy brought about by the 'energy squeeze': the consequences of a change over from petroleum-based to coal-based industry, the substantial changes in the transportation pattern for these fuels (previously from port refineries to inland users, now from the industrial heartland outwards), etc. Other energy issues such as the impact of increased hydro or nuclear or other sources, and the consumption rate of fuel wood must also be studied. In addition to changes in the input-output structures which reflect the changes in energy costs, we must be able to reflect the changed relative costs of other inputs and of imports.

Relative changes in prices also have important bearing on the income distribution front. Relatively favourable changes in the prices for agricultural commodities in relation to manufacturing goods might increase the rural per capita income but might adversely affect the population in the lower strata of both rural and urban areas in the beginning. A number of policy simulation studies could be conducted to analyse the effects of changes in sectoral terms of trade on income distribution and related policies. For example a tax could be imposed on the agricultural income to wipe out the inflationary gains and the additional resources thus mobilised could be invested in the basic needs sector and the resultant changes in the various socio-economic characteristics could be studied. This also requires explicit introduction of money supply and of interest rates in the model.

4.5 Balance of Payments

More elaborate treatment of the balance of payments would complement a deeper analysis of imports and exports. For the next ten years at least, remittances will remain a significant source of foreign exchange. For India the potential of tourism and of invisibles have still to be explored adequately. In the light of the rapid changes in technology, the rising prices of petroleum and international efforts at recycling petro-dollars, a more adequate module in this area could be very useful for policy analysis, especially in the context of the current North-South dialogue.

4.6 Restructuring the Model at State and Regional Levels

A subcontinent like India exhibits vast heterogeneity in the socio-economic characteristics across the regions. For example states like Kerala and Bihar are diametrically opposite if one considers the indicators of physical quality of life. Similarly states like Orissa and Punjab span the scale of economic development. Even within large states like Andhra Pradesh and Uttar Pradesh regional disparities are very prominent.

The historical pattern of economic and social development of various states in India has brought out certain interesting features. Kerala with a population of about 27 millions compares well with many developed countries in its indicators of the social and physical quality of life. However, this has not helped the economic development of the state, with the result that it continues to be one of the poorest and industrially backward states in the country. One may be tempted to conclude that investment in human resources does not lead to economic development! A model of the 'India Basic Needs' kind, however, if used at the state level, could analyse the causes and consequences of the low response elasticities of investments to basic needs satisfaction of the population.

Similarly, Punjab, economically the most developed state in India, has failed to show the gains of economic development on the physical quality of life in terms of education, infant mortality, life expectancy, housing, etc. The 'India Basic Needs' model, suitably adopted, could help to formulate developmental strategies of economic growth with satisfaction of selected basic needs. The same model can also be suitably modified for analysing the dualistic economies of states like

Uttar Pradesh, Andhra Pradesh, Maharashtra where traditional and modern sectors, economically backward regions as well as well developed regions co-exist. Policies related to sectoral investments, settlement patterns etc. aimed at bringing down the regional and sectoral disparities can be objectively evaluated.

State level models of the 'India Basic Needs' type are needed for other reasons too: State Planning Boards need tools with which to plan employment, education and health strategies. They must be able to assess the employment and education implications of the changing demographic picture in their states as it affects settlements of different sizes. The experience of Kerala State where both state and private activities have combined to provide high levels of many basic needs but where there is an acute shortage of employment, is instructive here. Most states spend a large part of their budget on education and health; the model would quickly identify the results a decade hence of the present distribution of this expenditure. The alternatives available for industrial development can also be related to other source of production and employment - agriculture, processing, tourism, to create a balanced pattern of growth.

There exists also a great need to study the settlement pattern to develop long term strategies for the overall development of the region. What is the benefit/cost to the economy of maintaining large cities? What are the types of migration (village to small and medium towns, to metropolitan cities etc.) to be encouraged/discouraged? To adequately study this problem it may be necessary to represent the population not merely in rural and urban categories but to break it up between metropolitan, medium city, small town, and village components. The geographic pattern of industries and of such services as education, health, housing, electricity and communications must also be represented.

4.7 Software Developments

The computer model as it currently stands is more suitable for use by the model-builder or technician than by the planner or policy-maker, who is not, and probably does not need to be, familiar with the details of the model. In this context, we are greatly concerned with making better use of computer capabilities to enable closer interaction of the user with the model. Two ways in which we can approach this concern are: (i) developing a policy interactive version, and (ii) modifying the outputs.

There is need to make the model more directly policy interactive. This was a problem also felt by the designers of Bachue-Philippines, as a result of which they created an interactive version of the model in which policy changes could be specified in response to prompts from the computer. In our present version, policy analysis requires the modeller to adjust several parameters; the user does not have many easy-to-use policy variables, particularly in the demographic, basic needs and income distribution subsystems. The model runs fast and conveniently on the computer so that it would seem appropriate to pay more attention now also to the manner in which the user can specify his policy alternatives.

With regard to modifying the outputs, we are able to present a summary table at the end of a policy run. This permits a rapid comparison of the values of important variables at 5- and 10-year intervals over the entire 30-year span. We are experimenting with various graphical formats to make the output more meaningful. In one such format, the trajectories of selected variables appear on a graph with time as the x-axis (much as LIMITS TO GROWTH results were presented). The visual display immediately makes evident the anomalous or unusual behaviour of any of the variables. A future extension of this idea would be to provide the user with a choice of output formats via an interactive dialogue.

A development in another direction would be to provide a more 'friendly' software environment for the construction of models. This would involve the development of a pre-processor which takes a model specified in the form of equations and other types of linkages, and generates a compilable model. The model-builder's task therefore would be limited to specifying the model, and he would be freed from the present high degree of dependence on computer programming. Some such system seems to be necessary if the extended use of

global models is not to remain restricted to specialised and well-staffed research groups. Similar systems have been developed in slightly different contexts at MIT (the TROLL system) and Cambridge University. Thus, this is an approach which would seem to be feasible given the current state-of-the-art in modelling and software. However, existing systems run on relatively large computers: we feel it is essential that this system should run on medium or small-sized computers of the kind more frequently found in LDCs.

It should be noted that each of the above mentioned follow up tasks by itself constitutes a substantial research project which we plan to undertake with the assistance of national and international agencies.

Appendix A: Data used for estimation of the Equations

State	CBR	CHILD	CHLDRP	CHLDUP	FLFPR	BPRE	BSC	$RCON_1$	$RCON_2$	$RCON_3$	$UCON_1$	$UCON_2$	$UCON_3$
Andhra	34.8	40.79	40.74	40.98	21.2	70.6	10.9	.7208	.0818	.1973	.6371	.1835	.1794
Bihar	32.8	43.24	43.49	41.03	5.9	56.7	13.8	.7840	.0733	.1427	.6835	.1684	.1481
Gujarat	40.0	42.95	44.47	39.07	7.1	83.8	24.4	.7691	.0808	.1501	.6834	.1683	.1483
J & K	32.9	43.14	43.32	44.38	4.0	63.0	19.6	.7138	.0780	.2081	.6680	.1422	.1898
Karnataka	31.7	42.42	42.86	41.07	13.0	89.0	14.7	.7210	.0844	.1945	.6579	.1698	.1723
Kerala	31.1	39.93	40.28	38.15	11.3	119.4	29.7	.7021	.1495	.1484	.6334	.1785	.1881
M.P.	39.1	44.52	44.90	42.57	15.8	60.4	13.1	.7226	.0782	.1992	.6341	.1823	.1836
Maharashtra	32.2	42.01	43.97	37.69	18.3	89.5	25.8	.6881	.1070	.2049	.6133	.2308	.1559
Punjab	34.2	41.58	42.37	39.03	1.1	72.7	21.3	.6780	.1098	.2122	.6106	.2111	.1783
Rajasthan	42.4	44.72	45.11	42.92	7.5	46.6	18.1	.7075	.0655	.2270	.6335	.1807	.1858
Tamil Nadu	31.4	38.19	38.14	38.14	12.8	106.7	26.6	.7502	.0857	.1641	.6543	.2059	.1398
U.P.	44.9	42.64	42.81	42.81	5.3	96.5	15.6	.7112	.0798	.2090	.6529	.1716	.1755
West Bengal	33.6	42.98	45.87	45.87	3.0	78.8	18.9	.8001	.0603	.1396	.6637	.1979	.1384

CBR : Crude birth rate
CHILD : % of children
CHLDRP : % of rural children
CHLDUP : % of urban children
FLFPR : Female labour force participation rate
BPRE : Primary school enrolment rate
BSC : Secondary school enrolment rate

$RCON_1$: Share of consumption of food in rural
$RCON_2$: Share of consumption of industry in rural
$RCON_3$: Share of consumption services in rural
$UCON_1$: Share of consumption food in urban
$UCON_2$: Share of consumpton industry in urban
$UCON_3$: Share of consumption services in urban

Appendix A (Contd.)

State	YP	BLIT	BNT	BMEXP	BEDEXP	BEO	BEAL	BHOS	BALAB	BWKP	BDEN	BUR
Andhra	478.0	24.57	43.37	6.10	10.90	45.0	2040	56.7	73.9	41.4	157	19.3
Bihar	402.0	19.94	34.56	3.45	7.30	41.0	1865	62.2	84.7	31.0	324	10.0
Gujarat	592.0	35.79	45.08	6.97	10.80	39.0	1612	90.9	67.9	31.5	136	28.1
J & K	513.0	18.58	46.41	10.47	11.70	44.0	2265	54.7	71.6	29.8	146	18.6
Karnataka	500.0	31.52	45.18	5.34	20.10	47.0	2200	74.4	71.3	34.7	153	24.3
Kerala	507.0	60.42	67.21	7.61	33.40	60.0	1842	48.6	56.0	36.7	549	16.2
M.P.	481.0	22.14	39.21	5.06	21.80	50.0	1950@	91.3	81.7	36.7	94	16.3
Maharashtra	700.0	39.18	72.66	8.07	11.30	45.0	2281	85.4	66.7	36.5	164	31.2
Punjab	811.0	33.67	92.12	7.71	23.30	49.0	2832	59.3	63.6	28.9	269	23.7
Rajasthan	428.0	19.07	38.76	8.15	15.30	37.0	2044	74.7	77.2	31.2	75	17.6
Tamil Nadu	557.0	39.46	44.72	6.53	12.20	45.0	1498	44.2	65.0	35.8	317	30.3
U.P.	476.0	21.70	39.23	3.51	11.10	43.0	2307	56.4	78.0	30.9	300	14.0
West Bengal	493.0	33.20	42.64	6.45	19.40	40.0	1927	53.1	62.3	27.9	504	24.7

YP : Per capita income
BLIT : Literacy rate
BNT : Per capita private expenditure on Basic Needs
BMEXP : Per capita public expenditure on health
BEDEXP : % of public expenditure on education
BEO : Female life expectancy

BCAL : Per capita calorie intake
BALAB : % of agricultural labour force
BHOS : % of pucca and semi pucca houses
BWKP : % of working population
BDEN : Population density
BUR : % of urban population

@ Own Estimate

Appendix B-1

Equations and Identities

Economic and Income Distribution

E 1. Per capita income

$$YP = \Sigma \hat{VA}_i / POP$$

where $\hat{VA}_i$ is the adjusted value added in the ith sector (see E 40.), POP is the total population.

E 2. Expected per capita income

$$EYP_t = YP_t \text{ for } t = 1 \& 2$$

$$EYP_t = YP_{t-1} (1 + (YP_{t-1} - YP_{t-2}) / YP_{t-2}) \text{ for } t > 2$$

E 3. Tax revenue

$$TAXREV = PTAX (W_i + \Pi_i) + t_i (VA_i - K_i) \qquad t \geq 2$$

where PTAX is tax rate on personal income (exogenously specified), t_i is profit tax rate (exogenously specified), W_i is the sectoral wages, Π_i is nonwage payments; K_i is the share of value added which is not distributed as earnings. (PTAX and t_i's are adjusted for in the initial year to tally with the tax revenue.)

For t = 1, tax revenue is exogenously specified.

E 4. Tax rate

TAX = TAXREV/GDP where GDP is the gross domestic product.

E 5. Percentage of child population

$$CHILD = \frac{\text{Population aged 0-14}}{\text{Total population}} \times 100$$

E 6. Percentage of child population in rural areas

$$CHLDRP = \frac{\text{Rural population aged 0-14}}{\text{Total rural population (RPOP)}} \times 100$$

E 7. Percentage of child population in urban areas

$$CHLDUP = \frac{\text{Urban population aged 0-14}}{\text{Total urban population (UPOP)}} \times 100$$

E 8. Expected rural per capita income

$EYAP = YA/RPOP \qquad t \geq 2$

where $YA = \sum VARR_i \ (\hat{VA}_i)$; $VARR_i$ (exogenously specified) is proportion of value added in sector i in rural

$EYAP = a\ (EYP)\ (POP) \ / \ RPOP \qquad t = 1$

where 'a' (exogenously specified) is proportion of total rural value added to total value added.

E 9. Expected urban per capita income

$EYNAP = YNA \ / \ UPOP \qquad t \geq 2$

$YNA = \sum VARU_i \ (\hat{VA}_i)$; $VARU_i$ (exogenously specified) is proportion of value added in sector i in urban.

$EYNAP = (1-a)\ (EYP)\ (POP) \ / \ UPOP \qquad t = 1$

E 10.* Total private consumption

$PCONT = (338.15 + .6152\ (EYP_t\ (1-TAX) - 3.8906\ (CHILD) + .1076\ (LOW\ 20))\ POP \qquad t \geq 2$

for t = 1 the value is exogenously specified

E 11. Share of food in rural consumption

$RCON_1 = .6829 + 63.78\ (1/EYAP) + .005\ (CHLDRP) \qquad t \geq 1$

E 12. Share of industry in rural consumption

$RCON_2 = .1825 - 38.14\ (1/EYAP) + .000941\ (CHLDRP) \qquad t > 1$

E 13. Share of services in rural consumption

$RCON_3 = .1346 - 26.25\ (1/EYAP) - .00592\ (CHLDRP) \qquad t > 1$

E 14. Share of food in urban consumption

$UCON_1 = .550 + 71.97\ (1/EYNAP) - .002229\ (CHLDUP) \qquad t > 1$

E 15. Share of industry in urban consumption

$UCON_2 = .227 - 34.14\ (1/EYNAP) + .004434\ (CHLDUP) \qquad t > 1$

E 16. Share of services in urban consumption

$UCON_3 = .223 - 38.32\ (1/EYNAP) - .0022\ (CHLDUP) \qquad t > 1$

E 17. $RCON = RCON_1 + RCON_2 + RCON_3$

E 18. $UCON = UCON_1 + UCON_2 + UCON_3$

Adjustments to ensure RCON = UCON = 1

E 19. $RCON_j = RCON_j - (RCON - 1.0)\ (RCON_j / RCON)$

E 20. $UCON_j = UCON_j - (UCON - 1.0)\ (UCON_j / UCON)$

E 21. $$CON_j = \frac{((RCON_j)\ (EYAP)\ (RPOP) + (UCON_j)\ (EYNAP)\ (UPOP))}{((EYAP)\ (RPOP) + (EYNAP)\ (UPOP))} \qquad j = 1,2,3$$

E 22. $PCON_1 = (C_1 / (C_1 + C_2))\ (CON_1)\ PCONT$

E 23. $PCON_2 = (C_2 / (C_1 + C_2))\ (CON_1)\ PCONT$

E 24. $PCON_i = (C_i / \Sigma C_i)\ (CON_2)\ PCONT \qquad i = 4,9$

E 25. $PCON_3 = (C_3 / (C_3 + C_{10}))\ (CON_3)\ PCONT$

E 26. $PCON_{10} = (C_{10} / (C_3 + C_{10}))\ (CON_3)\ PCONT$

where C_i is share of sectoral private consumption (specified exogenously), $PCON_i$ is the private consumption in the ith sector and PCONT is the total private consumption.

E 27. Savings (SAV); Savings gap (SAVGAP)

SAV = GDP - PCONT - TAXREV ; SAVGAP = SAV - PINVST

E 28. Total government consumption

$GCONT = (a_T)\ GOVT$

where a_T is the ratio of government consumption to total government expenditure and is exogenously specified.

E 29. Total government expenditure

GOVT = TAXREV + DEFICIT

E 30. Total government investment

$GINVT = (1 - a_T)\ GOVT$

E 31. Sectoral government consumption

$GCON_i = a_i \; GCONT$

where a_i is the consumption share of government in ith sector and is exogenously specified.

E 32. Sectoral investment demand (private)

$PINV_i = b_i \; PINVST$

where PINVST is total private investment and b_i is share of investment goods demand from the ith sector and is exogenously specified.

E 33. Sectoral government investment

$GINV_i = b_i \; GINVT$

E 34.* Per capita private investment demand

$$\ln (PINVST/POP) = (-5.904 + 1.1857 \ln (EYP_t) + .548 \ln (CHILD) + .0951 \ln (LOW\ 20)$$

$t \geq 2$

The initial value of PINVST is exogenously specified

E 35. Exports in each sector (see also E 52.)

$EXPT_i = d_i \; EXPT$

where d_i is the share of exports in the ith sector and EXPT is the total exports. d_i is exogenously specified.

E 36. $EXPT_{i,t} = EXPT_{i,\,t-1} (1 + e_{it})$ e_i's are (exogenous) growth rates.

E 37. Imports in each sector (see also E 49)

$MPT_i = m_i \; MPT$

where m_i's are exogenously specified for $t = 1$

$MPT_{i,t} = m_{i,t} \; F_{i,t}$ $\quad t \geq 2$

where $F_{i,t}$ is the final domestic demand in sector i in year t

$m_{i.t} = MPT_{i,\,t-1} \; / \; F_{i,\,t-1}$

where $F_{i,t} = PC_{i,t} + PINV_{i,t} + GCON_{i,t} + EXPT_{i,t}$.

E 38. Unadjusted net final demand

$Z_i = F_i - MPT_i \qquad i = 1,10$

E 39. Input output equation

$Z = Y - AY$ where Y is output vector and A is the technical coefficients matrix

$(I - A)\ Y = Z; \quad Y = (I-A)^{-1}\ Z$

E 40. Value added

$VA = Y.V$ where V is a diagonal matrix

$V_{ii} = 1 - \sum_{n=1}^{10} a_{ni}$; a_{ni} is an element of A.

E 41. Unadjusted current capacity $(X_{i,t})$

$(k_i)^{-1}\ I_{i,\ t-1} + \hat{X}_{i,\ t-1}\ (1+r_i + q_i)$

where $X_{i,t}$ is the adjusted capacity, r_i is the exogenous technical progress, $I_{i,t}$ is the investment in the ith sector, k_i is the incremental capital output ratio, q_i is the change in labour productivity per unit output which is obtained by dividing change in labour productivity by output labour ratio.

E 42. Desired investment

$I^*_{i,t} = (Y_{i,\ t} - X_{i,\ t-1})\ (k_i)^{-1}$ for $Y_{i,t} > X_{i,\ t-1}$

$= (I_{i,t-1} / \Sigma I_{i,\ t-1})\ I_{i,t}$ for $Y_{i,t} \leq X_{i,\ t-1}$

E 43. $I_{i,t} = (I_{i,\ t-1})\ \delta + I^*_{i,t}\ (1- \delta) \qquad 0 < \delta < 1$

subject to $\Sigma I_{i,t} = PINVST + GINVT$

where δ is exogenously specified.

E 44. Depreciation

$D_{i,t} = d.I_{i,t-1} + f.(VA_{i,t} - \hat{VA}_{i,\ t-1}) / \hat{VA}_{i,\ t-1}$

where d and f are exogenously specified.

E 45. Adjusted capacity

$$\hat{X}_{i,t} = (k_i)^{-1} (I_{i,t} - D_{i,t}) + \hat{X}_{i,\ t-1} (1+r_i + q_i)$$

E 46. The adjusted capacity excluding changes in labour productivity

$$\bar{X}_{i,t} = (k_i)^{-1}(I_{i,t} - D_{i,t}) + \hat{X}_{i,\ t-1} \quad (1 + r_i)$$

E 47. The feasible demand vector

$$Z = (I-A)\ \hat{X}.V$$

E 48. The difference between the unadjusted and the feasible demand

$$Q_i = Z_i - \hat{Z}_i \text{ if } Z_i > \hat{Z}_i$$

$$= (Z_i - \hat{Z}_i)\ \phi \quad o < \phi \leq 1 \qquad Z_i < \hat{Z}_i$$

where ϕ is exogenously specified

E 49. Adjusted imports

$$\hat{MPT}_i = (1+ \lambda_i^1)\ MPT_i \quad \text{(see E 53 for } \lambda^1)$$

E 50. Adjusted private consumption

$$\hat{PCON}_i = (1 - \lambda_i^2)\ PCON_i \quad \text{(see E 54 for } \lambda^2)$$

E 51. Adjusted government consumption

$$\hat{GCON}_i = (1 - \lambda_i^2)\ GCON_i$$

E 52. Adjusted exports

$$\hat{EXPT}_i = (1- \lambda_1^2)\ EXPT_i$$

E 53. $\lambda_i^1 = Q_i / (PCON_i + GCON_i + EXPT_i + MPT_i)$

E 54. $\lambda_i^2 = (Q_i - (\hat{MPT}_i - MPT_i) / (PCON_i + GCON_i + EXPT_i)$

E 55. Gross domestic product

$$GDP = \sum \hat{VA}_i$$

E 56. Change in supply of labour force (P is a location index taking the value R for rural and U for urban

$$\Delta L^P_{i,t} = \left(E^P_{i,\ t-1} / \Sigma E_{i,\ t-1} \right) x\ \Delta^P LAB_t$$

E^P_i is the no. of people in location employed in the ith sector.

$\Delta^P LAB$ is change in labour force.

E 57. Labour force per sector (Rural/Urban)

$$L^P_{i,t} = L^P_{i,\,t-1} + \Delta L^P_{i,t}$$

E 58. Unemployment rate

$$MU^P_{i,t} = MU^P_i \quad \frac{(\Delta L^P_{i,t}) / (L^P_{i,t})}{(\Delta \bar{X}^P_{i,t}) / (\bar{X}^P_{i,t})} \qquad t > 5$$

where $\Delta \bar{X}_{i,t}$ is change in capacity and $\bar{X}_{i,t}$ is capacity in sector i (see E 46)

$MU^P_{i,t} = MU^P_{i,1}$ $\quad t \leq 4$ (assumed constant for first five years)

E 59. $$MU^P_{i.} = MU^P_{i,1} \frac{L^P_{i,5} - L^P_{i,1}}{L^P_{i,1}} \Big/ \frac{\bar{X}^P_{i,5} - \bar{X}^P_{i,1}}{\bar{X}^P_{i,1}}$$

MU^P_i is computed in the fifth year by scaling the initial unemployment rates according to the ratio of the change in labour supply to the change in capacity over the first five years.

$MU^P_{i,1}$'s are exogeneously specified

$MU^P_i \geq MU^P_{i0}$ where MU^P_{i0} are(exogenous)set lower bounds to capture the rate of hard core unemployment.

E 60. Unemployment

$$U^P_{i,t} = MU^P_{i,t} \quad L^P_{i,t}$$

E 61. Employment

$$E^P_{i,t} = L^P_{i,t} - U^P_{i,t}$$

E 62*. The share of wages in G.D.P.

$$\ln (\alpha_i) = a^1_i + b^1 \ln (YP)$$

E 63. Sectoral wages

$$W_i = \alpha_i \; VA_i$$

E 64. The share of sectoral value added not distributed as factor payments

$K_i = \gamma_i \hat{VA}_i$ where γ_i's are specified exogenously.

E 65. Profits or non wage factor payments

$\Pi_i = \hat{VA}_i - W_i - K_i$

E 66. The division of workforce into employees

$EMPW_i^P = \epsilon_i E_i^P$

where E_i^P is total employed in the ith sector and ϵ_i's proportion of employees in the workforce are exogenously specified

E 67. Employers/self employed

$EMPB_i^P = E_i^P - EMPW_i^P$

E 68. Mean earnings of employees

$w_i = W_i / EMPW_i^P$

E 69. Mean earnings of employers and self employed

$P_i = \Pi_i (1-t_i) / EMPB_i^P$

where t_i is the profit tax rate, specified exogenously

Basic Needs Subsystem

F 1. Literacy rate

$$\log (BLIT) = -1.769 + .8389 \log (BEDEXP) + .2843 \log (BUR) + .5043 \log (YP)$$
$$(.9942) \qquad (.9663) \qquad (.9942)$$

$R^2 = .6092$

B 2. $BEDEXP = \frac{\text{Expenditure on education}}{\text{Total government expenditure}} \times 100$ is exogenously fixed.

B 3. $BUR = \frac{\text{Urban population}}{\text{Total population}} \times 100$ is computed

B 4. The per capita Basic Needs expenditure on private account

$$\log (BNT) = -2.003 + .2269 \log (BLIT) + 1.0086 \log (YP)$$
$$(1.603) \qquad (4.348)$$

$R^2 = .8035$

B 5. Primary school enrolment rate (BPRE) is defined as

$$\frac{\text{No. of children in primary schools}}{\text{Total children in the age group 5-9}} \times 100$$

$$BPRE = 118.5 + .8017\ (BEDEXP) - .8591\ (BALAB) - 1.048\ (CHILD)$$
$$(2.573) \qquad (-4.009) \qquad (-1.117)$$

$$R^2 = .8684$$

where BALAB is percentage of agriculture labour force

$$= ((E_{i,t} + E_{2,t}) / \Sigma E_{i,t}) \times 100$$

B 6. Secondary school enrolment rate (BSC) is defined as

$$\frac{\text{No. of children in secondary schools}}{\text{Total children in the age group 14-16}} \times 100$$

$$BSC = 10.09 + .2272\ (BNT) + .4229\ (BUR) + .01382\ (BDEN) + .4291\ (BWKP)$$
$$(1.1111) \qquad (2.039) \qquad (1.708) \qquad (1.360)$$

$$R^2 = .6311$$

where BDEN is density of population and BWKP is the percentage of working population = $(\Sigma E_{i,t}/POP) \times 100$

B 7. The female life expectancy at birth

$$BEO = 27.85 + .3631\ (FLFPR) + .2140\ (BNT) + 1.115\ BMEXP$$
$$(1.758) \qquad (1.048) \qquad (2.175)$$

$$R^2 = .5535$$

where FLFPR is female labour force participation rate and BMEXP is per capita public health expenditure which is exogenously specified.

B 8. Percentage of pucca and semi pucca houses

$$BHOS = 51.44 - .5986\ (BLIT) + .8397\ (FLFPR) + .3670\ (BUR) + .03135\ (YP)$$
$$(-1.225) \qquad (.9797) \qquad (.3442) \qquad (.5130)$$

$$R^2 = .24$$

B 9. The per capita calorie intake BCAL

$$BCAL = 1446 + 3.163\ (YP) - 27.15\ (BUR) - 24.35\ (BSC)$$
$$(4.265) \qquad (-1.892) \qquad (-1.692)$$

$$R^2 = .6614$$

B 10. Labour productivity

$$BQL = 407.50 + 16.99\ (BEO) + 6.331\ (BNT) + 28.25\ (BHOS) + 2.784\ (K/L)$$
$$(.1524) \qquad (1.287) \qquad (.8815) \qquad (.3001)$$

$$R^2 = .3681$$

where K/L is capital labour ratio. Thus

$$\Delta BQL = 16.99\ \Delta BEO + 6.331\ \Delta BNT + 28.25\ \Delta BHOS$$

and change in labour productivity per unit output

$$q_i = (\Delta BQL.\ L_i\ .w_i) / Y_i\ W_i$$

B 11. Energy availability index (EAVIN) is defined as

$$EAVIN = \frac{\text{Private consumption of energy (PCON}_9\text{)}}{\text{Total domestic energy requirement}}$$

B 12. Total domestic requirement of energy

= Domestic per capita requirement x total population

B 13. $(\text{Domestic per capita energy requirement})_{t+1}$

$= (\text{Domestic per capita energy requirement})_t x(1 + g)$

where g is exogenously specified growth rate.

Demographic Subsystem

D 1. When t = 1, CBR (crude birth rate) is specified exogeneously and for $t \geq 2$ it is estimated as follows

$$\log (CBR) = 2.8493 - .0328 \log BLIT - .7305 \log (BEO) - .01059 \log (IUD)$$
$$(-.2329) \qquad (-2.616) \qquad (.1261)$$

where BLIT is literacy rate, BEO is female life expectancy at birth (see B 7) and IUD is percentage of couples adapting family planning (assumed to be growing at an exogenously given rate).

$$(IUD)_{t+1} = IUD_t\ (1+.03)$$

D 2. Total number of births is given by

$$TNB = \frac{CBR \times POP}{1000}$$ where POP is total population

D 3. Overall fertility rate

$$FR = \frac{TNB}{\text{Population aged 14-44}} \times 1000$$

D 4.* Female labour force participation rate

$$FLFPR = 38.44 + \underset{(2.65)}{2630\,(1/YP)} - \underset{(2.03)}{.407\,(FR)} - \underset{(.88)}{.1352\,(100-BLIT)} \qquad t > 1$$

$$R^2 = .52$$

D 5.* Net rural to urban migration propensity is computed separately for the 3 age groups 0-14, 15-44, and 45+;

for the age group 15-44

$$\ln (RUM^2_t) = 6.8232 - \underset{(3.61)}{1.043 \ln (100-BLIT)} + \underset{(2.49)}{.6473 \ln (DIF)} \qquad t > 1$$

$$R^2 = .45$$

For the age group 0-14

$$RUM^1_t = .5\, RUM^2_t$$

For the age group 45+

$$RUM^3_t = .3\, RUM^2_t$$

where DIF is rural-urban per capita income differential

$$DIF = \left(\frac{YNA}{UPOP} - \frac{YA}{RPOP}\right) / \left(\frac{YA}{RPOP}\right).$$

D 6. The number of (net) rural to urban migrants in various age groups is

$$RUMM^{s,k}_t = RUM_t \times RP^{s,k} \quad \text{for all } s,k$$

$$RUM_t \begin{cases} = RUM^1_t \\ = RUM^2_t \\ = RUM^3_t \end{cases} \quad \text{for} \quad \begin{cases} k \leq 14 \\ 15 \leq k \leq 44 \\ k \geq 45 \end{cases}$$

D 7. Net rural population (in various age groups and sex wise) =

$RP_t^{s,k} - RUMM_t^{s,k}$

D 8. Net urban population (in various age groups and sex wise) =

$UP_t^{s,k} + RUMM_t^{s,k}$

D 9. The age and sexwise survival probabilities are given by $S^{s,k} = f$ (BEO, CDMLT) where CDMLT is the Coale Demeny model life table of which $S^{s,k}$ is one column. (The male life expectancy at birth is also calculated here).

D 10. Projected rural population (sex and age wise)

$$RP_{t+1}^{s,k} = (RP_t^{s,k-1} - RUMM_t^{s,k-1})\ S^{s,k-1}$$

D 11. $$RPOP_{t+1} = \sum_{s,k} RP_{t+1}^{s,k}$$

D 12. $$UP_{t+1}^{s,k} = (UP_t^{s,k-1} + RUMM_t^{s,k-1})\ S^{s,k-1}$$

D 13. $$UPOP_{t+1} = \sum_{s,k} UP_{t+1}^{s,k}$$

D 14. $$POP_{t+1} = RPOP_{t+1} + UPOP_{t+1}$$

D 15. Crude death rate

$$CDR = \frac{POP_t + TNB_t - POP_{t+1}}{POP_t} \times 100$$

D 16. Rural birth rate

$$RLBR = \frac{\text{Total rural births}}{\text{Total rural population}} \times 1000$$

where total rural births are in proportion to the rural population in the age group 14-44.

D 17. Rural fertility rate

$$RFR = \frac{\text{Total number of rural births}}{UPOP} \times 1000$$

D 18. Urban crude birth rate

$$UCBR = \frac{\text{Total number of urban births}}{UPOP} \times 1000$$

D 19. Urban fertility rate

$$UFR = \frac{\text{Total number of urban births}}{\text{Total number of urban aged 14-44}} \times 1000$$

D 20. Rural population growth rate

$$= \frac{RPOP_{t+1} - RPOP_t}{\frac{1}{2}(RPOP_{t+1} + RPOP_t)} \times 100$$

D 21. Urban population growth rate

$$= \frac{UPOP_{t+1} - UPOP_t}{\frac{1}{2}(UPOP_{t+1} + UPOP_t)} \times 100$$

D 22. Total population growth rate

$$= \frac{POP_{t+1} - POP_t}{\frac{1}{2}(POP_{t+1} + POP_t)} \times 100$$

D 23. Rural labour force $RLAB = \sum_{s,k} RP^{s,k} \; AR^{s,k}$

$AR^{s,k}$ are rural age specific labour force participation rates

D 24. Urban labour force $ULAB = \sum_{s,k} UP^{s,k} \; AU^{s,k}$

$AU^{s,k}$ are urban age specific labour force participation rates. The age specific labour force participation rates (for 5 year intervals for the age groups 5-64 and 65+) for males are computed from 1971 census data. These are assumed to be constant over time. The female labour force participation rate is computed for each year (see D 4.) but is assumed to be the same for all the age groups (i.e. $\frac{FLFPR}{100}$).

D 25. Urban dependency rate $= \frac{UPOP}{ULAB}$

Rural dependency rate $= \frac{RPOP}{RLAB}$

---

* The coefficients in these equations are those estimated by Dr R Scott Moreland in his "Bachue International" (WEP WP?0, ILO)

Appendix B-2: Variable Dictionary

a	=	Proportion of total rural value added to total value added
a_i^1	=	Constants in the equations for share of wages in G.D.P.
a_i	=	Consumption share of government in the ith sector
a_T	=	Ratio of government consumption to total government expenditure
A	=	Technical coefficient matrix
$AR^{s,k}$	=	Rural age specific labour force participation rates
$AU^{s,k}$	=	Urban age specific labour force participation rates (for each sex s and age group k = 0-1, 1-4 5-9, 10-14, 15-19, 20-24, 25-29, 30-34, 35-39, 40-44, 45-49 50-54, 55-59, 60-64, 65+)
b^1	=	Coefficient of YP in the equation for share of wages in G.D.P.
b_i	=	Share of investment demand for goods from the ith sector
BALAB	=	Percentage of agriculture labour force to total labour force.
BCAL	=	Per capita calorie intake (calories)
BDEN	=	Population density (population per sq. k.m.)
BEDEXP	=	Percentage of public educational expenditure
BEO	=	Female life expectancy at birth (years)
BHOS	=	Percentage of pucca and semi pucca houses to total houses
BLIT	=	Percentage of literate population to total population
BMEXP	=	Per capita medical (public) expenditure (rupees)
BNT	=	Per capita private Basic Needs expenditure (rupees)
BPRE	=	Primary school enrolment rate (per 100)
BQL	=	Labour productivity
BSC	=	Secondary school enrolment rate (per 100)
BUR	=	Percentage of urban population
C_i	=	Share of sectoral private consumption
CBR	=	Crude birth rate (per 1000)
CDR	=	Crude death rate (per 1000)
CHILD	=	Percentage of child population in the age group 0-14 (to the total population)
CHLDRP	=	Percentage of rural child population in the age group 0-14
CHLDUP	=	Percentage of urban child population in the age group 0-14
CON_1	=	Share of food in total consumption (private)
CON_2	=	Share of industry in total consumption (private)
CON_3	=	Share of services in total consumption (private)

d_i = Share of exports in each sector

D_i = Depreciation (Rs. Millions) of capital stock in ith sector

DEFICIT = Government deficit (Rs. Millions)

DIF = Rural-urban per capita income differential

e_i = Rate of growth of exports

E_i = Total employed in sector i (Millions)

E_i^p = Total employed in sector i location wise (Millions)

EAVIN = Energy availability index

$EMPB_i$ = No. of self employed/employers in sector i (Millions)

$EMPW_i$ = No. of employees in sector i (Millions)

EXPT = Total exports (Rs. Millions)

$EXPT_i$ = Exports sector-wise (Rs. Millions)

EYP = Expected per capita income (Rupees)

EYAP = Expected rural per capita income (Rupees)

EYNAP = Expected urban per capita income (Rupees)

F_i = Domestic demand in the ith sector (Rs. Millions)

FLFPR = Female labour force participation rate (per 100)

FR = Overall fertility rate (per 1000)

g = Growth rate of domestic (per capita) energy requirement

GCONT = Total government consumption (Rs. Millions)

GDP = Gross domestic product (Rs. Millions)

$GINV_i$ = Sectoral government investment demand from ith sector (Rs.Millions)

GINVT = Total government investment (Rs. Millions)

GOVT = Total governmental spending (Rs. Millions)

I_i = Total investment in each sector (Rs. Millions)

I_i^* = Total desired investment in each sector (Rs. Millions)

IUD = Percentage of couples adapting family planning

k_i = Incremental capital output ratio

K_i = Sectoral value added not distributed as factor payments (Rs. Millions)

K/L = Capital labour ratio

$L_{i,t}^p$ = Supply of labour force in ith sector (location wise) (Millions)

LAB^p = Total supply of labour force (location-wise) (Millions)

LOW 20 = Percentage of income earned by lowest 20% of the population

m_i = Sectoral share of imports

MPT_i = Total imports in each sector (Rs. Millions)

MPT = Total imports (Rs. Millions)

$MU^{P}_{i,t}$ = Rural/urban unemployment rate in each sector (per 100)

P_i = Mean wage earnings of employers and self employed (Rupees)

$PCON_i$ = Private consumption sector-wise (Rs. Millions)

PCONT = Total private consumption (Rs. Millions)

$PINV_i$ = Private investment demand from ith sector (Rs. Millions)

PINVST = Total private investment (Rs. Millions)

PTAX = Tax rate on personal income

q_i = Change in labour productivity per unit of output (Rupees)

Q_i = Difference between unadjusted and feasible demand (Rs. Millions)

r_i = Rate of technical progress

RCBR = Rural Crude birth rate (per 1000)

RCON = Total share of rural consumption

$RCON_1$ = Share of food in rural consumption

$RCON_2$ = Share of industry in rural consumption

$RCON_3$ = Share of services in rural consumption

RLAB = Total supply of rural labour force (Millions)

$RP^{s,k}$ = Rural population (k) age and (s) sexwise (Millions)

RPOP = Total rural population (Millions)

RUM = Net rural to urban migration propensity (per 1000)

RUMM = Net rural to urban migrants (Millions)

SAVGAP = Savings gap (Rs. Millions); SAV = Savings (Rs. Millions)

t_i = Profit tax rate

TAX = Overall tax rate (defined as tax revenue/GDP)

TAXREV = Tax revenue (Rs. Millions)

TNB = Total number of births (Millions)

UCBR = Urban crude birth rate (per 1000)

UCON = Total share of urban consumption

$UCON_1$ = Share of food in urban consumption (private)

$UCON_2$ = Share of industry in urban consumption (private)

$UCON_3$ = Share of services in urban consumption (private)

ULAB = Total supply of urban labour force (Millions)

U^{P}_{it} = Total unemployed in sector i (location-wise) (Millions)

$UP^{s,k}$ = Urban Population(s) sex and (k) age-wise (Millions)

V = Diagonal matrix with $V_{ii} = 1 - \sum_{n} a_{ni}$

where a_{ni} is an element of A

VA_i = Unadjusted value added in sector i (Rs. Millions)

$\hat{VA}_i$ = Adjusted value added in sector i (Rs. Millions)

$VARR_i$ = Proportion of value added in rural to total value added in sector i

$VARU_i$ = Proportion of value added in urban to total value added in sector i

w_i = Mean wage earnings of employees (Rupees)

W_i = Total wages in sector i (Rs. Millions)

X_i = Unadjusted capacity in sector i (Rs. Millions)

$\hat{X}_i$ = Adjusted capacity in sector i (Rs. Millions)

$\bar{X}_i$ = Adjusted capacity excluding the change in labour productivity in sector i (Rs. Million)

Y = Output vector

YA = Total rural value added (Rs. Millions)

YNA = Total urban value added (Rs. Millions)

YP = Per capita income (Rupees)

Z_i = Net domestic demand in sector i (Rs. Millions)

$\hat{Z}_i$ = Feasible final demand in sector i (Rs. Millions)

$\overline{\Pi}_i$ = Non wage factor payments (Rs. Millions)

δ^i = Inter period adjustment factor

ϕ = Adjustment factor for the existence of excess of capacity when feasible final demand is greater than unadjusted final demand

λ^1_i = Factor used to adjust import when unadjusted final demand is greater than the feasible final demand

λ^2_i = Factor for adjusting consumption and export components of final demand if greater than feasible final demand

α_i = Share of wages in G.D.P.

γ_i = Proportion of value added not distributed as factor payments

ϵ_i = Proportion of employees to total employed in sector i

$\triangle BQL$ = Change in labour productivity

Exogeneous Parameters which can be used to test Alternative Policies

a_i = Consumption share of government in ith sector

a_T = Ratio of government consumption to total government expenditure

b_i = Share of investment demand for goods from the ith sector

BEDEXP = Percentage of public educational expenditure

BMEXP = Per capita medical expenditure

C_i = Share of sectoral private consumption

$CMPT_i$ = Percentage reduction of imports in ith sector

d_i = Share of exports in ith sector

e_i = Growth rate of exports

g = Growth rate of domestic (per capita) energy requirement

IUD = Percentage of couples adopting family planning

k_i = Incremental capital output ratio

r_i = Rate of technical progress

γ_i = Proportion of value added which is not distributed as factor earnings

t_i = Profit tax rate

δ = Inter period adjustment factor for investment

ϵ_i = Proportion of employees in total employed.

Appendix C

Data used to initialize the model

A note on Estimation:

Most of the behavioural equations specified in the model are estimated from cross section data related to 13 states in India for the year 1970-71. A number of alternate specifications were tried for each equation and the variables and the form finally selected were based both on theoretical considerations as well as on the statistical significance of the coefficients.

Data used to initialise the model:

a = .585

a_T = .5513

$AU^{s,k}$ = See Table C-1

b_i = See Table C-2

BDEN = 166.73

BHOS = 57.3%

BMEXP = Rs. 6.00

BPRE = 69.57%

BSC = 20.50%

CBR = 42.0

DEFICIT = Rs. 4691 (Millions)

EXPT = Rs. 15350.99 (Millions)

g = .01

IUD = 13.2%

LAB^P_i = See Table C-3

m_i = See Table C-2

MU^{Rural}_i = 8.9% for all i

PCONT = Rs. 281550.26 (Millions)

a^1_i = See Table C-3

$AR^{s,k}$ = See Table C-1

b^1 = .1819

BCAL = 1985 cals

BEDEXP = 16.43%

BLIT = 29.85%

BNT = Rs. 15.40

RQL = Rs. 20.00

C_i = See Table C-3

d_i = See Table C-2

e_i = See Table C-2

FLFPR = 17.22%

GOVT = Rs. 41353 (Millions)

k_i = See Table C-2

LOW 20 = 5.79%

MPT = Rs. 17342.01 (Millions)

MU^{Urban}_i = 6.2% for all i

PINVST = Rs. 34389.8 (Millions)

PTAX	= .1645	r_i	= See Table C-2
$RCON_1$	= .6829	$RCON_2$	= .1825
$RCON_3$	= .1346	$RP^{s,k}$	= See Table C-1
RUM	= 7.2	t_i	= See Table C-2
$UCON_1$	= .55	$UCON_2$	= .227
$UCON_3$	= .223	$UP^{s,k}$	= See Table C-1
δ^3	= .25	ϕ	= 1.0
ϵ_i	= See Table C-3	γ	= See Table C-3

Table C-1 : Population by age, sex and location and Male labour force participation rates (1971)

Age	Rural ($RP^{s,k}$)		$AR^{2,k}$	Urban ($UP^{s,k}$)		$AU^{2,k}$
	Female	Male	MLFPR	Female	Male	MLFPR
0 - 1	6.819	6.877	.0000	1.394	1.492	.0000
1 - 4	25.628	26.129	.0000	5.155	5.765	.0000
5 - 9	32.583	34.527	.1055	7.205	7.689	.0395
10 -14	25.853	29.333	.1242	6.428	7.159	.0424
15-19	17.263	19.258	.6210	4.983	5.964	.3313
20 -24	16.799	15.845	.8631	4.729	5.728	.6745
25 -29	16.343	15.519	.9533	4.138	4.819	.9053
30 -34	14.453	14.110	.9756	3.411	4.210	.9551
35 -39	12.622	13.405	.9756	3.043	3.833	.9551
40 -44	10.795	11.754	.9758	2.433	3.305	.9516
45 -49	8.586	9.844	.9758	1.832	2.622	.9516
50 -54	7.785	8.943	.9544	1.628	2.170	.8786
55 -59	4.964	5.632	.9544	0.990	1.247	.8786
60 -64	5.737	6.232	.7726	1.156	1.252	.5535
65 +	7.494	7.908	.7726	1.499	1.538	.5535

$RP^{s,k}$, $UP^{s,k}$ (Millions), MLFPR : Male Labour force participation rate (per individual)

Table C-2 : Exogenous or Policy Variables

Sector	Rate of Tech. Progress r_i	Share of exports d_i	Profit tax rate t_i	Exports growth rates e_i	Govt. Cons. Sectoral a_i	Incr. Cap. - output ratio k_i	Share of imports m_i
Food	.0025	.225	.05	.02	.01377	0.90	.179
Agriculture	.0025	.180	.15	.02	.01003	1.24	.170
Basic Needs	.0200	.000	.25	.00	.23472	3.48	.000
Textiles	.0100	.225	.30	.03	.01400	3.40	.003
Chemicals	.0150	.054	.30	.02	.00835	2.06	.143
Heavy Industries	.0200	.224	.30	.03	.04475	5.46	.400
Light Industries	.0150	.081	.30	.02	.03841	4.00	.028
Construction	.0200	.000	.25	.00	.09237	8.00	.000
Energy	.0100	.010	.30	.00	.00885	4.95	.077
Services	.0200	.000	.25	.00	.53475	3.18	.000

Table C-3 : Exogenous or Policy Variables

Sector	b_i	C_i	ϵ_i	γ_i	LAB_i Rural	LAB_i Urban	a_i^1
Food	.900	.509	.53	.004	86.89	3.40	.7889
Agriculture	.010	.131	.53	.020	38.82	1.77	.9642
Basic Needs	.199	.030	.84	.011	1.43	2.87	.8394
Textiles	.000	.072	.84	.042	4.78	2.57	.9642
Chemicals	.000	.024	.84	.219	0.29	0.77	.9642
Heavy Industries	.488	.017	.84	.119	0.37	2.16	.9642
Light Industries	.049	.034	.84	.143	2.72	2.77	.9642
Construction	.204	.043	.64	.144	3.97	2.65	1.0377
Energy	.000	.006	.84	.288	0.52	0.54	1.11807
Services	.050	.133	.63	.026	8.32	12.75	0.9561

(See Appendix B-2 also)

Appendix D: Sectors in the input-output Matrix

The I/O matrix used in India Basic Needs Model was obtained from the Department of Political Economy at Glasgow University (see Sinha et al in references). The original matrix consisted of 77 sectors (at 1967-68 prices). For the purpose of the present model these have been grouped into 10 as given below:

1. Food: Rice, Wheat, Pulses, Grams, Other foodgrains, Fruits and vegetables, Tea and coffee, Sugar, Gur, Vanaspati, Vegetable oil, Spices, Other food products.

2. Agriculture and Allied: Cotton, Jute, Oilseeds, Sugarcane, Tobacco, Other agriculture, Animal husbandry, Mining, Forestry and plantation.

3. Other Basic Needs: Housing (Rural and Urban Construction), Education, Medical care.

4. Textiles and Allied: Cotton textiles, Cotton yarn, Jute textiles, Woolen yarn and fabrics, Art silk fabrics, Silk and silk products, Other textiles.

5. Chemicals and Allied: Manmade fibres, Fertilizers, Chemicals, Plastics, Cosmetics and medicines, Petroleum products, Refractories.

6. Heavy Industry: Cement, Iron and steel, Non-ferrous metals, Metal products, Non-electrical machinery, Motor vehicles, Aircrafts and ships, Railway equipment and other equipment.

7. Light Industry: Cigarettes and cigars, Other tobacco products, Wood products, Paper and paper products, Leather footwear, Leather, Other leather products, Electrical household goods, Radio and other electrical goods, Bicycles, Motorbicycles, Watches and clocks, Misc. scientific equipment, Other industries, Printing & publishing.

8. Construction & Transport: Other construction, General pucca construction, Railway transport, Other transport.

9. Energy: Coal, Miscellaneous coal, and Petroleum products, Crude oil and Electricity.

10. Services: Entertainment, Domestic services, and Other services.

Table D.1: Input-Output Structure of India (1967-68)

(Rs. Million)

Sectors	Food	Agri-culture	Basic Needs	Textiles	Chemicals	Heavy Indust-ries	Light Indu-stries	Constru-ction & Transport-ation	Energy	Services
Food	8660.6	2975.4	0.0	9.4	464.1	0.9	11.1	0.0	0.0	0.0
Agriculture	23447.7	8841.3	1282.2	5173.0	677.4	738.7	3016.7	1028.6	0.3	0.0
Basic Needs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	46.9
Textiles	174.6	2.7	79.6	8584.7	68.7	333.9	385.7	86.1	0.4	0.0
Chemicals	2680.2	545.1	1349.5	1512.3	3431.7	705.5	1245.7	2161.3	83.9	0.0
Heavy Industries	316.4	78.3	1962.2	144.7	494.0	7884.9	1496.0	4836.5	149.1	16.3
Light Industries	206.9	17.3	1172.6	273.3	362.1	783.9	3106.3	1533.5	205.3	301.9
Construction & Transportation	2855.7	1186.7	120.0	820.6	690.4	1436.1	1142.7	1579.9	288.7	29.7
Energy	363.6	98.8	0.0	435.1	1940.8	1300.1	284.0	874.0	1442.9	350.0
Services	224.3	2.7	0.0	275.9	580.4	647.8	702.4	47.8	107.5	0.0

APPENDIX - E

Alternative Strategies under G1 and G2 Scenarios

The possible strategies under the two scenarios G1 and G2 are grouped under six categories as follows:

I. G1.R1
II. G1.R2
III. G1.R1R2
IV. G2.R1
V. G2.R2
VI. G2.R1R2

Six alternative scenarios each under G1.R1 and G2.R1 were spelled out and tried, and four scenarios each under G1.R2, G1.R1R2, G2.R2, and G2.R1R2, as follows:

Scenarios under G1.R1

1. North-oriented export expansion with minimisation of imports in all sectors except energy.
2. North-oriented export expansion with minimisation of imports in consumer goods industries.
3. North-oriented exports expansion with minimisation of imports in all sectors except energy plus more expenditure on "basic needs" sector.
4. North-oriented exports expansion with minimisation of imports in all sectors except energy plus favourable internal terms of trade for agriculture.
5. North-oriented export expansion with minimisation of imports in all sectors except energy plus favourable internal terms of trade for agriculture and increased expenditure on basic needs.
6. North-oriented export expansion with favourable internal terms of trade for agriculture and increased expenditure on basic needs.

Scenarios under G1.R2

1. North-oriented export expansion with increased expenditure on basic needs plus no restriction on imports.

2. North-oriented export expansion with no restriction on imports.

3. North-oriented export expansion with unfavourable internal terms of trade for agriculture plus no restriction on imports.

4. North-oriented export expansion with increased expenditure on basic needs plus unfavourable internal terms of trade for agriculture and no restriction on imports.

Scenarios under G1.R1R2

1. North-oriented export expansion with minimising imports for the first fifteen years and then no restriction on imports.

2. As in 1 plus increased expenditure on basic needs.

3. North-oriented export expansion with favourable internal terms of trade for agriculture plus no import restrictions for the first 15 years.

4. North-oriented export expansion with import reduction in consumer goods industries for the first fifteen years plus unfavourable internal terms of trade for agriculture.

Scenarios under G2.R1, G2.R2, G2.R1R2 can also be explained along the same lines except for the fact that the export expansion is south-oriented and imports are reduced in capital goods sectors instead of in the consumer goods sectors.

Appendix F: Results of Base Run and Selected Strategies

Input data for selected strategies

Strategy	Exports (See Table F1)	Imports	Favourable terms of trade for agriculture	Increased investment in Basic Needs
1	As in G1 scenario	3% reduction in all sectors except energy throughout the period	Profit tax rate is reduced to zero in the first three sectors, increased to 35% in all other sectors(except light industries where it is 25%)	Public and private investment in Basic Needs is increased by 10% every year for the first 10 years.
2	As in G2 scenario	-- do --	-- do --	-- do --
3	As in G1 scenario	No restriction on imports	No restriction on terms of trade	-- do --
4	As in G2 scenario	-- do --	-- do --	-- do --

Table F1 : Rate of Growth of Exports from Sector i (percent)

Sector	Normal	G1 Scenario		G2 Scenario	
Year	1-30	1-15	16-31	1-15	16-30
Food	2.0	5.0	5.0	2.5	2.5
Agriculture	2.0	5.0	5.0	2.5	2.5
Basic Needs	0.0	0.0	0.0	0.0	0.0
Textiles	3.0	9.0	8.0	4.0	4.0
Chemicals	2.0	2.0	2.0	10.0	8.0
Heavy Industry	3.0	3.0	3.0	12.0	10.0
Light Industry	2.0	9.0	8.0	8.0	6.0
Construction	0.0	0.0	0.0	0.0	0.0
Energy	0.0	0.0	0.0	0.0	0.0
Services	0.0	0.0	0.0	0.0	0.0

SUMMARY TABLE

Base Run Results

		1970-71		1980-81		1990-91		2000-01	
Demographic Outcomes		A	P	A	P	A	P	A	P
Total Population	(Mill.)	548.2	0.0	658.1	0.0	802.8	0.0	979.5	0.0
Urban Population	(%)	19.9	0.0	22.4	0.0	24.8	0.0	26.8	0.0
Urban Growth Rate	(%)	3.8	0.0	3.1	0.0	2.8	0.0	2.7	0.0
Rural Growth Rate	(%)	2.0	0.0	1.7	0.0	1.7	0.0	1.7	0.0
Urban Birth Rate	(per 1000)	36.1	0.0	32.0	0.0	28.4	0.0	25.0	0.0
Rural Birth Rate	(" ")	43.5	0.0	38.0	0.0	34.9	0.0	32.1	0.0
Total Birth Rate	(" ")	42.0	0.0	36.6	0.0	33.3	0.0	30.2	0.0
Total Fertility Rate	(" ")	189.8	0.0	158.6	0.0	143.3	0.0	124.3	0.0
Urban Dependency Rate		3.0	0.0	2.8	0.0	2.6	0.0	2.5	0.0
Rural Dependency Rate		3.2	0.0	3.0	0.0	2.9	0.0	2.6	0.0
Migration Propensity	(per 1000)	7.2	0.0	6.4	0.0	6.2	0.0	6.5	0.0
Female Lab. Part. Rate	(%)	17.2	0.0	22.4	0.0	25.6	0.0	30.5	0.0
Economic Structure									
Total Pvt. Investment	(Rs. Mill.)	34389.8	0.0	45717.1	0.0	64611.8	0.0	82700.0	0.0
Govt. Investment	(" ")	20449.5	0.0	26054.2	0.0	35885.7	0.0	45758.7	0.0
Govt. Tax Revenue	(" ")	40883.9	0.0	54969.9	0.0	76872.5	0.0	99599.9	0.0
Private Consumption	(" ")	281550.2	0.0	379335.1	0.0	514411.3	0.0	659075.5	0.0
Govt. Consumption	(" ")	25125.4	0.0	32676.3	0.0	46798.7	0.0	58585.8	0.0
Consumption, Food	(%)	64.0	0.0	62.5	0.0	61.1	0.0	60.3	0.0
Consumption, Industry	(%)	19.7	0.0	19.6	0.0	20.2	0.0	20.0	0.0
Consumption, Services	(%)	16.3	0.0	17.9	0.0	18.7	0.0	19.6	0.0
Total Exports	(Rs. Mill.)	15351.0	0.0	20228.1	0.0	31436.7	0.0	45582.9	0.0
Total Imports	(" ")	17342.0	0.0	21358.0	0.0	23948.2	0.0	28995.9	0.0
Gross Domestic Product	(Rs. Mill.)	346770.6	0.0	166163.7	0.0	650742.4	0.0	842700.7	0.0
Output Primary	(" ")	180735.7	0.0	237367.0	0.0	314929.9	0.0	403740.6	0.0
Output Manufacturing	(" ")	104667.6	0.0	141373.4	0.0	209810.3	0.0	277736.9	0.0
Output Tertiary	(" ")	61367.2	0.0	87423.3	0.0	126002.3	0.0	161223.2	0.0
GDP, Primary	(%)	52.1	0.0	50.9	0.0	48.4	0.0	47.9	0.0
GDP, Manufacturing	(%)	30.2	0.0	30.3	0.0	32.2	0.0	33.0	0.0
GDP, Tertiary	(%)	17.7	0.0	18.8	0.0	19.4	0.0	19.1	0.0

	1970-71		1980-81		1990-91		2000-01	
Labour and Employment	A	P	A	P	A	P	A	P
Rural Labour Force (Mill.)	136.8	0.0	168.1	0.0	211.8	0.0	271.1	0.0
Rural Employment (")	124.6	0.0	140.2	0.0	175.2	0.0	222.1	0.0
Rural Unemployment Rate (%)	8.9	0.0	16.6	0.0	17.3	0.0	18.1	0.0
Urban Labour Force (Mill.)	35.9	0.0	52.9	0.0	75.9	0.0	106.5	0.0
Urban Employment (")	33.7	0.0	49.3	0.0	69.6	0.0	97.8	0.0
Urban Unemployment Rate (%)	6.2	0.0	6.9	0.0	8.3	0.0	8.1	0.0
Income Distribution								
Income Per Capita (Rs)	632.6	0.0	708.4	0.0	810.6	0.0	860.3	0.0
Income Per Adult Eq. (Rs)	780.3	0.0	869.2	0.0	990.7	0.0	1040.9	0.0
Income Per Adult Eq.R(Rs)	635.0	0.0	718.8	0.0	823.3	0.0	882.5	0.0
Income Per Adult Eq.U(Rs)	1205.9	0.0	1191.6	0.0	1285.3	0.0	1266.1	0.0
Share of Wages (%)	24.7	0.0	24.8	0.0	25.4	0.0	25.7	0.0
Mean Wage Pay, Rural (Rs)	1048.8	0.0	1153.2	0.0	1245.1	0.0	1231.8	0.0
Mean Wage Pay, Urban (Rs)	3234.2	0.0	3231.0	0.0	3572.0	0.0	3457.9	0.0
Mean Non-wage Pay, Rural (Rs)	2395.8	0.0	2733.5	0.0	2841.8	0.0	2821.3	0.0
Mean Non-wage Pay, Urban (Rs)	4303.0	0.0	4385.5	0.0	4509.0	0.0	4269.5	0.0
Overall Gini	.38	.0	.37	.0	.37	.0	.37	.0
Share of Low 20 in Income(%)	4.2	0.0	4.5	0.0	4.4	0.0	4.5	0.0
Share of Low 40 in Income(%)	14.1	0.0	14.7	0.0	14.6	0.0	14.8	0.0
Basic Needs								
Illiteracy Rate (%)	70.1	0.0	67.3	0.0	63.2	0.0	52.4	0.0
Primary School Enrolment Rate (%)	69.6	0.0	75.4	0.0	77.5	0.0	81.4	0.0
Secondary School Enrolment Rate (%)	20.5	0.0	26.5	0.0	28.1	0.0	33.2	0.0
Female Life Expectancy (Years)	44.7	0.0	50.0	0.0	56.4	0.0	63.7	0.0
Per Capita Calorie Cons. (Cals)	1985.0	0.0	2014.9	0.0	2219.9	0.0	2225.4	0.0
Agriculture Labour (%)	72.4	0.0	68.8	0.0	67.2	0.0	65.6	0.0
Working Population (%)	30.3	0.0	30.0	0.0	31.5	0.0	33.4	0.0
Basic Needs Cons. Per Capita (Rs)	15.4	0.0	18.4	0.0	23.1	0.0	26.2	0.0
Labour Productivity Annual Change (Rs)	20.0	0.0	10.0	0.0	13.9	0.0	6.2	0.0
Pucca Houses (%)	57.3	0.0	60.8	0.0	63.6	0.0	61.2	0.0
Energy Availability Index	.32	.0	.32	.0	.32	.0	.31	.0

SUMMARY TABLE

Strategy 1

		1970-71		1980-81		1990-91		2000-01	
Demographic Outcomes		A	P	A	P	A	P	A	P
Total Population	(Mill.)	548.2	0.0	658.0	0.0	863.0	0.0	980.7	0.1
Urban Population	(%)	19.9	0.0	22.5	0.4	25.0	0.8	27.2	1.5
Urban Growth Rate	(%)	3.8	0.0	3.2	2.3	2.9	2.3	2.8	2.5
Rural Growth Rate	(%)	2.0	0.0	1.6	-1.3	1.7	-1.0	1.7	-0.8
Urban Birth Rate	(per 1000)	36.1	0.0	31.7	-0.8	28.1	-1.2	24.5	-1.9
Rural Birth Rate	(" ")	43.5	0.0	37.6	-0.9	34.5	-1.3	31.4	-2.1
Total Birth Rate	(" ")	42.0	0.0	36.3	-0.9	32.9	-1.3	29.6	-2.1
Total Fertility Rate	(" ")	189.8	0.0	157.1	-0.9	141.1	-1.5	121.3	-2.4
Urban Dependency Rate		3.0	0.0	2.8	0.0	2.6	0.3	2.5	0.4
Rural Dependency Rate		3.2	0.0	3.0	0.0	2.9	0.4	2.7	0.6
Migration Propensity	(per 1000)	7.2	0.0	6.7	5.1	6.6	5.2	6.9	5.4
Female Lab. Part. Rate	(%)	17.2	0.0	22.3	-0.5	25.2	-1.4	29.8	-2.1
Economic Structure									
Total Pvt. Investment	(Rs. Mill.)	34389.8	0.0	53917.6	17.9	101551.9	57.2	175802.9	112.6
Govt. Investment	(" ")	20449.5	0.0	29335.0	12.6	44385.2	24.0	63822.1	39.8
Govt. Tax Revenue	(" ")	40883.9	0.0	63156.4	14.9	97857.7	27.3	143163.2	43.7
Private Consumption	(" ")	281550.2	0.0	414442.7	9.3	606619.1	17.9	849664.5	28.9
Govt. Consumption	(" ")	25125.4	0.0	36041.9	10.3	56161.1	20.0	78659.5	34.3
Consumption, Food	(%)	64.0	0.0	61.3	-1.9	59.3	-3.0	57.8	-4.1
Consumption, Industry	(%)	19.7	0.0	20.2	3.2	21.1	4.5	21.3	6.1
Consumption, Services	(%)	16.3	0.0	18.5	3.3	19.6	4.8	20.9	6.4
Total Exports	(Rs. Mill.)	15351.0	0.0	23779.4	17.6	45879.3	44.9	78154.8	71.5
Total Imports	(" ")	17342.0	0.0	4652.7	-78.2	7381.7	-69.2	10971.3	-62.2
Gross Domestic Product	(Rs. Mill.)	346770.6	0.0	534502.0	14.7	825481.4	26.9	1206072.0	43.1
Output Primary	(" ")	180735.7	0.0	266850.2	12.4	387015.2	22.9	550797.0	36.4
Output Manufacturing	(" ")	104667.6	0.0	168183.0	19.0	282344.4	34.6	429776.0	54.7
Output Tertiary	(" ")	61367.2	0.0	99468.8	13.8	156121.6	23.9	225498.4	39.9
GDP, Primary	(%)	52.1	0.0	49.9	-2.0	46.9	-3.1	45.7	-4.7
GDP, Manufacturing	(%)	30.2	0.0	31.5	3.8	34.2	6.1	35.6	8.1
GDP, Tertiary	(%)	17.7	0.0	18.6	-0.8	18.9	-2.3	18.7	-2.3

Contd.....

	1970-71		1980-81		1990-91		2000-01	
Labour and Employment	A	P	A	P	A	P	A	P
Rural Labour Force (Mill.)	136.8	0.0	167.9	10.2	210.5	-0.6	268.4	-1.0
Rural Employment (")	124.6	0.0	140.5	0.2	177.7	1.4	225.7	1.6
Rural Unemployment Rate (%)	8.9	0.0	16.3	-1.7	15.6	-9.9	15.9	-11.9
Urban Labour Force (Mill.)	35.9	0.0	53.1	0.4	76.3	0.6	107.7	1.2
Urban Employment (")	33.7	0.0	49.6	0.6	70.7	1.6	101.0	3.2
Urban Unemployment Rate (%)	6.2	0.0	6.6	-3.8	7.4	-10.6	6.3	-22.6
Income Distribution								
Income Per Capita (Rs)	632.6	0.0	812.4	14.7	1028.0	26.8	1229.9	43.0
Income Per Adult Eq. (Rs)	798.3	0.0	996.5	14.6	1255.3	26.7	1488.0	42.8
Income Per Adult Eq. R (Rs)	635.0	0.0	813.5	13.2	1023.5	24.3	1229.0	39.3
Income Per Adult Eq. U (Rs)	1205.9	0.0	1391.7	16.8	1668.6	29.8	1861.3	47.0
Share of Wages (%)	24.7	0.0	25.4	2.3	26.5	4.1	27.4	6.4
Mean Wage Pay, Rural (Rs)	1048.8	0.0	1339.3	16.1	1606.7	29.0	1832.0	48.7
Mean Wage Pay, Urban (Rs)	3234.2	0.0	3839.3	18.8	4760.7	33.3	5284.9	52.8
Mean Non-wage Pay, Rural (Rs)	2395.8	0.0	3042.1	11.3	3382.7	19.0	3677.7	30.4
Mean Non-wage Pay, Urban (Rs)	4303.0	0.0	4869.5	11.0	5323.3	18.1	5299.4	24.1
Overall Gini	.38	.0	.38	.9	.38	.4	.37	.7
Share of Low 20 in Income (%)	4.2	0.0	4.3	-3.0	4.4	-0.9	4.4	-1.4
Share of Low 40 in Income (%)	14.1	0.0	14.5	-1.5	14.6	-0.4	14.7	-1.0
Basic Needs								
Illiteracy Rate (%)	70.1	0.0	67.0	-0.5	64.1	1.4	54.7	4.0
Primary School Enrolment Rate (%)	69.6	0.0	75.4	0.1	77.4	-0.1	81.5	0.1
Secondary School Enrolment Rate (%)	20.5	0.0	27.1	2.2	30.2	4.6	35.5	7.1
Female Life Expectancy (Years)	44.7	0.0	50.6	1.1	57.6	1.9	65.8	3.2
Per Capita Calorie Cons. (Cals)	1985.0	0.0	2327.0	15.5	2869.1	29.2	3325.9	49.5
Agriculture Labour (%)	72.4	0.0	68.5	-0.4	66.9	-0.4	64.8	-1.3
Working Population (%)	30.3	0.0	30.1	0.3	31.9	1.4	34.1	1.9
Basic Needs Cons. Per Capita (Rs)	15.4	0.0	21.1	15.0	29.6	28.2	38.0	44.9
Labour Productivity Annual Change	20.0	0.0	31.1	72.6	28.8	107.6	32.4	426.3
Pucca Houses (%) (Rs)	57.3	0.0	63.8	5.0	70.9	11.5	74.1	21.1
Energy Availability Index	.32	.0	.36	14.0	.40	24.9	.43	39.8

A : Actual Values; P : % change from Base Run values.

SUMMARY TABLE

Strategy 2

	1970-71		1980-81		1990-91		2000-01	
Demographic Outcomes	A	P	A	P	A	P	A	P
Total Population (Mill.)	548.2	0.0	657.9	0.0	802.8	0.0	980.0	0.0
Urban Population (%)	19.9	0.0	22.5	0.5	25.2	1.3	27.4	2.1
Urban Growth Rate (%)	3.8	0.0	3.2	3.2	2.9	3.0	2.8	2.5
Rural Growth Rate (%)	2.0	0.0	1.6	-1.9	1.7	-1.7	1.7	-1.4
Urban Birth Rate (Per 1000)	36.1	0.0	31.7	-0.8	28.1	-1.1	24.7	-1.4
Rural Birth Rate (" ")	43.5	0.0	37.6	-1.0	34.5	-1.3	31.6	-1.6
Total Birth Rate (" ")	42.0	0.0	36.3	-0.9	32.9	-1.3	29.7	-1.6
Total Fertility Rate(" ")	189.8	0.0	156.9	-1.0	141.0	-1.6	121.9	-1.9
Urban Dependency Rate	3.0	0.0	2.8	-0.1	2.6	0.6	2.5	0.2
Rural Dependency Rate	3.2	0.0	3.0	-0.1	2.9	0.1	2.7	0.3
Migration Propensity (Per 1000)	7.2	0.0	3.8	7.1	6.7	7.3	7.0	6.7
Female Lab. Part. Rate (%)	17.2	0.0	22.4	0.0	25.4	-0.9	30.1	-1.3
Economic Structures								
Total Pvt. Investment (Rs. Mill.)	34389.8	0.0	53284.2	16.6	98497.8	52.4	149297.6	80.5
Govt. Investment (" ")	20449.5	0.0	29164.4	11.9	43542.6	21.6	58554.5	28.2
Govt. Tax Revenue (" ")	40883.9	0.0	62674.3	14.0	95335.7	24.0	129799.6	38.3
Private Consumption (" ")	281550.2	0.0	412357.1	8.7	595498.0	15.8	791184.5	20.0
Govt. Consumption (" ")	25125.4	0.0	35824.4	9.6	55068.0	17.7	73091.6	24.8
Consumption, Food (%)	64.0	0.0	61.3	-1.9	59.4	-2.7	58.4	-3.2
Consumption, Industry (%)	19.7	0.0	20.2	3.0	21.0	4.1	21.0	4.6
Consumption, Services (%)	16.3	0.0	18.5	3.2	19.6	4.6	20.6	5.1
Total Exports (Rs. Mill.)	15351.0	0.0	21852.9	8.0	39663.7	26.2	61045.1	33.9
Total Imports (" ")	17342.0	0.0	4837.1	-77.4	7793.6	-67.5	12850.1	-55.7
Gross Domestic Product (Rs. Mill.)	346770.6	0.0	530169.5	13.7	803594.6	23.5	1092937.0	29.7
Output Primary (Rs. Mill.)	180735.7	0.0	263326.6	10.9	373333.2	18.5	498007.6	23.3
Output Manufacturing (Rs. Mill.)	104667.6	0.0	168135.8	18.9	276950 .5	32.0	388448.7	39.9
Output Tertiary (Rs. Mill.)	61367.2	0.0	98707.0	12.9	153310.9	21.7	206489.0	28.1
GDP, Primary (%)	52.1	0.0	49.7	-2.5	46.5	-4.0	45.6	-4.9
GDP, Manufacturing (%)	30.2	0.0	31.7	4.6	34.5	6.9	35.5	7.8
GDP, Tertiary (%)	17.7	0.0	18.6	-0.7	19.1	-1.5	18.9	-1.2

Contd...

	1970-71		1980-81		1990-91		2000-01	
Labour and Employment	A	P	A	P	A	P	A	P
Rural Labour Force (Mill.)	136.8	0.0	168.1	0.0	210.6	-0.6	268.2	-1.1
Rural Employment (")	124.6	0.0	140.3	0.1	173.4	-1.0	215.7	-2.9
Rural Unemployment Rate (%)	8.9	0.0	16.5	-0.5	17.7	2.3	19.6	8.4
Urban Labour Force (Mill.)	35.9	0.0	53.2	0.6	76.9	1.3	108.5	1.9
Urban Employment (")	33.7	0.0	49.7	0.7	70.5	1.3	99.8	2.0
Urban Unemployment Rate (%)	6.2	0.0	6.8	-1.7	8.2	-0.4	8.1	-0.6
Income Distribution								
Income Per Capita (Rs)	632.6	0.0	805.8	13.8	1001.0	23.5	1115.3	29.6
Income Per Adult Eq. (Rs)	788.3	0.0	988.4	13.7	1222.2	23.4	1347.6	29.5
Income Per Adult Eq. R (Rs)	635.0	0.0	804.3	11.9	993.0	20.6	1116.5	26.5
Income Per Adult Eq. U (Rs)	1205.9	0.0	1387.0	16.4	1629.0	26.7	1677.8	32.5
Share of Wages (%)	24.7	0.0	25.3	2.2	26.4	3.8	26.9	4.7
Mean Wage Pay, Rural (Rs)	1048.8	0.0	1322.9	14.7	1577.9	26.7	1677.0	36.1
Mean Wage Pay, Urban (Rs)	3234.2	0.0	3830.1	18.5	4693.5	31.4	4832.1	39.7
Mean Non-wage Pay, Rural (Rs)	2395.8	0.0	3006.8	10.0	3341.4	17.6	3484.4	23.5
Mean Non-wage Pay, Urban (Rs)	4303.0	0.0	4862.8	10.9	5298.0	17.5	5112.8	19.8
Overall Gini	.38	0.0	.38	1.3	.37	0.3	.37	0.9
Share of Low 20 in Income (%)	4.2	0.0	4.3	-3.6	4.4	-0.8	4.4	-3.0
Share of Low 40 in Income (%)	14.1	0.0	14.4	-2.1	14.6	-0.3	14.6	-1.5
Basic Needs								
Illiteracy Rate (%)	70.1	0.0	66.5	-1.3	63.7	0.7	53.5	2.1
Primary School Enrolment Rate (%)	69.6	0.0	75.5	0.2	77.8	0.4	82.1	0.8
Secondary School Enrolment Rate (%)	20.5	0.0	27.1	2.2	30.2	4.5	35.0	5.5
Female Life Expectancy (Years)	44.7	0.0	50.6	1.2	57.5	1.9	65.2	2.3
Per Capita Calorie Cons. (Cals)	1985.0	0.0	2305.8	14.5	2781.8	25.3	2972.2	33.6
Agriculture Labour (%)	72.4	0.0	68.5	-0.5	66.5	-1.0	64.4	-1.9
Working Population (%)	30.3	0.0	30.0	0.3	31.3	-0.3	33.0	-1.4
Basic Needs Cons. Per Capita (Rs)	15.4	0.0	21.0	14.3	29.0	26.0	35.4	35.1
Labour Productivity Annual Change (Rs)	20.0	0.0	29.8	64.9	27.2	96.5	17.0	176.1
Pucca Houses (%)	57.3	0.0	63.4	4.3	69.8	9.9	69.9	14.3
Energy Availability Index	.32	0.0	.36	12.6	.40	23.9	.40	28.6

SUMMARY TABLE

Strategy 3

Demographic Outcomes	1970-71 A	1970-71 P	1980-81 A	1980-81 P	1990-91 A	1990-91 P	2000-01 A	2000-01 P
Total Population (Mill.)	548.2	0.0	658.0	0.0	802.7	0.0	979.5	0.0
Urban Population (%)	19.9	0.0	22.4	0.1	24.9	0.4	27.1	1.0
Urban Growth Rate (%)	3.8	0.0	3.1	0.8	2.9	1.7	2.8	3.0
Rural Growth Rate (%)	2.0	0.0	1.7	-0.6	1.7	-1.1	1.7	-1.5
Urban Birth Rate (per 1000)	36.1	0.0	31.9	-0.3	28.2	-0.9	24.6	-1.5
Rural Birth Rate (" ")	43.5	0.0	37.9	-0.3	34.6	-1.0	31.6	-1.7
Total Birth Rate (" ")	42.0	0.0	36.5	-0.3	33.0	-1.0	29.7	-1.7
Total Fertility Rate (")	189.8	0.0	158.0	-0.3	141.8	-1.1	121.9	-1.9
Urban Dependency Rate	3.0	0.0	2.8	-0.1	2.6	-0.3	2.5	-0.1
Rural Dependency Rate	3.2	0.0	3.0	-0.1	2.8	-0.4	2.6	-0.1
Migration Propensity (per 1000)	7.2	0.0	6.5	1.8	6.5	4.1	7.0	6.7
Female Lab. Part. Rate (%)	17.2	0.0	22.4	0.3	25.8	0.7	30.4	-0.4
Economic Structure								
Total Pvt. Investment (Rs. Mill.)	34389.8	0.0	48016.7	5.0	74788.0	15.7	135212.7	63.5
Govt. Investment (" ")	20449.5	0.0	26903.1	3.3	39278.2	9.7	57104.1	25.1
Govt. Tax Revenue (" ")	40883.9	0.0	57231.4	4.1	85565.9	11.3	127913.0	28.4
Private Consumption (" ")	281550.2	0.0	389320.2	2.6	551967.2	7.3	784216.6	19.0
Govt. Consumption (" ")	25125.4	0.0	33627.2	2.9	50344.2	7.6	71301.6	31.7
Consumption, Food (%)	64.0	0.0	62.2	-0.6	60.2	-1.4	58.6	-2.0
Consumption, Industry (%)	19.7	0.0	19.8	0.9	30.6	2.1	20.9	4.4
Consumption, Services (%)	16.3	0.0	18.1	0.9	19.2	2.2	20.5	4.5
Total Exports (Rs. Mill.)	15351.0	0.0	27261.1	34.8	56309.8	79.1	100765.5	121.1
Total Imports (" ")	17342.0	0.0	22357.3	4.7	26607.2	11.1	38303.7	32.1
Gross Domestic Product (Rs. Mill.)	346770.6	0.0	485235.6	4.1	723906.3	11.2	1080640.0	28.2
Output Primary (Rs. Mill.)	180735.7	0.0	245952.8	3.6	346939.2	10.2	502490.9	24.5
Output Manufacturing (Rs. Mill.)	104667.6	0.0	148832.0	5.2	239924.2	14.4	377445.8	35.9
Output Tertiary (Rs. Mill.)	61367.2	0.0	90450.8	3.5	137042.9	8.8	200703.4	24.5
GDP, Primary (%)	52.1	0.0	50.7	-0.5	47.9	-1.0	46.5	-2.9
GDP, Manufacturing (%)	30.2	0.0	30.7	1.1	33.1	2.8	34.9	6.0
GDP, Tertiary (%)	17.7	0.0	18.6	-0.6	18.1	-2.2	18.6	-2.9

Labour and Employment	1970-71 A	1970-71 P	1980-81 A	1980-81 P	1990-91 A	1990-91 P	2000-01 A	2000-01 P
Rural Labour Force (Mill.)	136.8	0.0	163.2	0.1	212.2	0.2	270.2	-0.3
Rural Employment (")	124.6	0.0	142.4	1.5	183.4	4.7	238.3	7.3
Rural Unemployment Rate (%)	8.9	0.0	13.4	-7.4	13.6	-21.3	11.8	-34.5
Urban Labour Force (Mill.)	35.9	0.0	53.0	0.1	76.5	0.8	107.6	1.1
Urban Employment (")	33.7	0.0	49.7	0.8	71.1	2.2	102.4	2.7
Urban Unemployment Rate (%)	6.2	0.0	6.3	-8.6	7.0	-15.7	4 .9	-40.3
Income Distribution								
Income Per Capita (Rs)	632.6	0.0	737.4	4.1	901.7	11.3	1103.2	28.2
Income per Adult Eq. (Rs)	788.3	0.0	904.8	4.1	1101.8	11.2	1333.4	28.1
Income Per Adult Eq. R (Rs)	635.0	0.0	746.2	3.8	910.9	10.6	1114.3	26.3
Income Per Adult Eq. U (Rs)	1205.9	0.0	1245.5	4.5	1437.5	11.9	1650.1	30.3
Share of Wages (%)	24.7	0.0	34.9	0.6	25.9	1.8	26.8	4.3
Mean Wage Pay, Rural (Rs)	1048.8	0.0	1196.4	3.7	1365.3	9.7	1573.3	27.7
Mean Wage Pay, Urban (Rs)	3234.2	0.0	3354.0	3.8	3938.0	10.2	4438.7	28.4
Mean Non-wage Pay, Rural (Rs)	2395.8	0.0	2791.9	2.1	2989.6	5.2	3245.0	15.0
Mean Non-wage Pay, Urban (Rs)	4303.0	0.0	4470.8	1.9	4728.2	4.9	4751.5	11.3
Overall Gini	.38	0.0	.37	0.5	.38	0.9	.37	1.1
Share of Low 20 In Income (%)	4.2	0.0	4.4	-0.7	4.3	-2.8	4.4	-3.2
Share of Low 40 in Income (%)	14.1	0.0	14.6	-0.6	14.4	-1.4	14.6	-1.7
Basic Needs								
Illiteracy Rate (%)	70.1	0.0	66.8	-0.9	61.9	-2.2	51.9	-0.9
Primary School Enrolment Rate (%)	69.6	0.0	75.4	0.0	77.2	-0.3	81.3	-0.2
Secondary School Enrolment Rate (%)	20.5	0.0	26.7	0.6	29.6	2.3	34.8	5.0
Female Life Expectancy (Years)	44.7	0.0	30.2	0.4	57.1	1.1	65.2	2.3
Per Capita Calorie Cons. (Cals)	1985.0	0.0	2102.1	4.3	2489.8	12.2	2946.4	32.4
Agriculture Labour (%)	72.4	0.0	68.8	0.0	67.5	0.4	65.4	-0.3
Working Population (%)	30.3	0.0	30.4	1.3	32.7	3.9	35.6	6.3
Basic Needs Cons. Per Capita (Rs)	15.4	0.0	19.3	4.9	26.1	13.3	35.2	34.1
Labour Productivity Annual Change	20.0	0.0	21.8	21.0	26.3	89.7	31.6	413.4
Pucca Houses (%) (Rs)	57.3	0.0	61.4	1.0	65.7	3.4	68.6	12.1
Energy Availability Index	.32	0.0	.33	3.8	.36	11.1	.39	26.8

SUMMARY TABLE

Strategy 4

Demographic Outcomes	1970-71		1980-81		1990-91		2000-01	
	A	P	A	P	A	P	A	P
Total Population (Mill.)	548.2	0.0	658.0	0.0	802.6	0.0	979.2	0.0
Urban Population (%)	19.9	0.0	22.4	0.1	25.0	0.7	27.2	1.6
Urban Growth Rate (%)	3.8	0.0	3.1	1.2	2.9	2.8	2.8	3.9
Rural Growth Rate (%)	2.0	0.0	1.7	-0.8	1.7	-1.9	1.7	-2.5
Urban Birth Rate (per 1000)	36.1	0.0	31.9	-0.2	28.2	-0.6	24.8	-0.9
Rural Birth Rate (" ")	43.5	0.0	37.9	-0.3	34.6	-0.8	31.7	-1.2
Total Birth Rate (" ")	42.0	0.0	36.5	-0.3	33.0	-0.8	29.8	-1.2
Total Fertility Rate (")	189.8	0.0	158.1	-0.3	142.0	-0.9	122.5	-1.4
Urban Dependency Rate	3.0	0.0	2.9	-0.1	2.6	-0.3	2.5	-0.1
Rural Dependency Rate	3.2	0.0	3.0	-0.1	2.8	-0.3	2.6	0.0
Migration Propensity (per 1000)	7.2	0.0	6.6	2.8	6.7	7.0	7.2	9.8
Female Lab. Part. Rate (%)	17.2	0.0	22.4	0.2	25.8	0.7	30.4	-0.2
Economic Structure								
Total Pvt. Investment (Rs. Mill.)	34389.8	0.0	47331.4	3.5	71101.7	10.0	117589.9	42.2
Govt. Investment (" ")	20449.5	0.0	26694.6	2.5	38515.0	7.6	53544.3	17.3
Govt. Tax Revenue (" ")	40883.9	0.0	56688.2	3.1	83613.8	8.8	118862.7	19.3
Private Consumption (" ")	281550.2	0.0	386754.7	2.0	542799.5	5.5	742675.4	12.7
Govt. Consumption (" ")	25125.4	0.0	33380.4	2.2	49491.0	5.8	67177.7	14.7
Consumption, Food (%)	64.0	0.0	62.2	-0.4	60.4	-1.1	59.0	-2.2
Consumption, Industry (%)	19.7	0.0	19.7	0.7	20.5	1.6	20.7	3.1
Consumption, Services (%)	16.3	0.0	18.0	0.8	19.1	1.9	20.3	3.5
Total Exports (Rs. Mill.)	15351.0	0.0	26471.5	30.9	56351.5	79.3	102978.8	125.9
Total Imports (" ")	17342.0	0.0	23652.0	10.7	32982.8	37.7	58098.9	100.4
Gross Domestic Product (Rs. Mill.)	346770.6	0.0	480424.4	3.1	706608.9	8.6	1002770.0	19.0
Output Primary (Rs. Mill.)	180735.7	0.0	242259.4	2.1	333825.7	6.0	459281.4	13.8
Output Manufacturing (Rs. Mill.)	104667.6	0.0	148295.4	4.9	237719.3	13.3	354969.4	27.8
Output Tertiary (Rs. Mill.)	61367.2	0.0	89869.6	2.8	135063.9	7.2	188518.6	16.9
GDP, Primary (%)	52.1	0.0	50.4	-1.0	47.2	-2.4	45.8	-4.4
GDP, Manufacturing (%)	30.2	0.0	30.9	1.8	33.6	4.3	35.4	7.4
GDP, Tertiary (%)	17.7	0.0	18.7	-0.3	19.1	-1.3	18.8	-1.7

Contd...

	1970-71		1980-81		1990-91		2000-01	
Labour and Employment	A	P	A	P	A	P	A	P
Rural Labour Force (Mill.)	136.8	0.0	168.2	0.0	212.0	0.1	269.5	-0.6
Rural Employment (")	124.6	0.0	141.8	1.1	181.2	3.4	232.9	4.8
Rural Unemployment Rate (%)	8.9	0.0	15.7	-5.4	14.5	-16.0	13.6	-24.8
Urban Labour Force (Mill.)	34.9	0.0	53.0	0.2	76.7	1.0	108.3	1.7
Urban Employment (")	33.7	0.0	49.6	0.6	71.0	2.0	102.0	4.3
Urban Unemployment Rate (%)	6.2	0.0	6.4	-6.4	7.4	-10.8	5.3	-28.4
Income Distribution								
Income Per Capita (Rs)	632.6	0.0	730.1	3.1	880.4	8.6	1023.9	19.0
Income Per Adult Eq. (Rs)	788.3	0.0	895.8	3.1	1075.5	8.6	1237.8	18.9
Income Per Adult Eq. R (Rs)	635.0	0.0	736.3	2.4	881.6	7.1	1026.4	16.3
Income Per Adult Eq. U (Rs)	1205.9	0.0	1239.3	4.0	1418.9	10.4	1542.1	21.8
Share of Wages (%)	24.7	0.0	24.9	0.5	25.8	1.4	26.5	3.0
Mean Wage Pay, Rural (Rs)	1048.8	0.0	1180.6	2.4	1319.7	6.0	1435.8	16.6
Mean Wage Pay, Urban (Rs)	3234.2	0.0	3348.5	3.6	3918.4	9.7	4181.1	20.9
Mean Non-wage Pay, Rural (Rs)	2395.8	0.0	2761.5	1.0	2910.6	2.4	3042.1	7.8
Mean Non-wage Pay, Urban (Rs)	4303.0	0.0	4477.2	2.1	4742.8	5.2	4650.4	8.9
Overall Gini	.38	.0	.38	1.0	.38	0.5	.37	0.7
Share of Low 20 in Income (%)	4.2	0.0	4.3	-3.1	4.4	-1.0	4.4	-1.4
Share of Low 40 in Income (%)	14.1	0.0	14.5	-1.6	14.6	-0.5	14.7	-0.9
Basic Needs								
Illiteracy Rate (%)	70.1	0.0	66.8	-0.7	62.0	-2.0	51.8	-1.1
Primary School Enrolment Rate (%)	69.6	0.0	75.4	+0.0	77.3	-0.2	81.6	0.2
Secondary School Enrolment Rate (%)	20.5	0.0	26.7	0.5	29.4	1.9	34.4	3.7
Female Life Expectancy (Years)	44.7	0.0	50.2	0.3	56.9	0.9	64.8	1.6
Per Capita Calorie Cons. (Cals)	1985.0	0.0	2079.6	3.2	2422.5	9.1	2701.2	21.4
Agriculture Labour (%)	72.4	0.0	68.8	0.0	67.4	0.2	65.2	-0.7
Working Population (%)	30.3	0.0	30.3	0.9	32.4	2.9	35.0	4.6
Basic Needs Cons. Per Capita (Rs)	15.4	0.0	19.1	3.8	25.5	10.5	32.4	23.6
Labour Productivity Annual Change (Rs)	20.0	0.0	20.9	15.9	24.4	75.7	21.1	242.6
Pucca Houses (%)	57.3	0.0	61.2	0.7	65.1	2.5	66.1	8.1
Energy Availability Index	.32	.0	.33	2.9	.35	8.5	.36	17.9

Appendix G

Major differences between Bachue International and "India Basic Needs" Model

The structure of the "India Basic Needs" Model draws heavily from Bachue International. There are some major differences, however, apart from the coefficients of the freshly estimated equations, and we list some of them below:

Bachue International consists of 3 subsystems which are: (1) Demographic (2) Economic (3) Income Distribution. In our model we have combined the economic and income distribution subsystems and created a new subsystem called the Basic Needs subsystem. This has been created to estimate primary and secondary school enrolment rates, per capita calorie consumption (commercial), energy availability index, % of pucca and semi pucca houses (serviceable) and change in labour productivity due to change in Basic Needs satisfaction.

Demographic Subsystem

In the international version overall fertility (based on the population 14-44) is estimated as a behavioural equation, whereas we estimate crude birth rate. In the educational equations of our model we have used enrolment rate instead of completion rate because of lack of adequate information.

Economic Subsystem

Instead of the first three sectors of the Bachue International, viz. (1) Agriculture, (2) Mining and (3) Food products, we have just two, viz., (1) Food crops and (2) Other Agriculture and Mining. A new third sector 'Basic Needs' is created, consisting of Housing, Health and Education. Instead of the generalised Bachue International I/O matrix, we have taken a77 sectpr I/O matrix for India and condensed it to 10 sectors.

In Bachue International the Agriculture and Mining sectors were treated as 'rural', and all the others as 'urban'. This is correct for most smaller LDCs. In India, however, with so many smaller towns, some adjustment is needed. In our model it is assumed that there are "rural" and "urban" components in all the sectors. Corresponding changes were needed in the labour force and value added distributions. Also the final consumption equations for primary, secondary and tertiary products

have been estimated for rural and urban areas separately and the share of each sector determined, whereas in Bachue International rural and urban consumption is estimated together.

Income Distribution Subsystem

We found that the separate computation of the income distributions for 4 groups - employers and employed, for both rural and urban took nearly 20 minutes for each run, whereas the rest of the run took virtually no time. It was decided therefore to limit the computation to the overall income distribution only. We consequently lose the detail on 'rural' and 'urban', 'employees' and 'employers' which is provided in Bachue International. In a recent communication Dr R. Scott Moreland has recommended a new and faster algorithm to compute these distributions.

REFERENCES

The following books and reports were repeatedly referred to in this study. A large number of others were also looked at.

(a) Books

1. Bhagwati, J., and Padma Desai (1970) : India Planning for Industrialization (OECD and Oxford University Press, New Delhi)

2. Cohen, S.I. (1975) : Production, Manpower and Social Planning (Rotterdam University Press)

3. Nair, K.N.S., (1980) : Technological Changes in Agriculture, Impact on Productivity and Employment (BISR, Economic Research Division, Vision Books, New Delhi)

4. Rodgers, G., Mike Hopkins and Rene Wery (1978) : Bachue-Philippines: Population Employment and Inequality (Saxon House, London)

5. Rudra, A. (1979) : The Basic Needs Concept and its Implementation in Indian Development Planning, Asian Regional Programme for Employment Promotion, ILO, Bangkok

6. Sinha, R., Peter Pearson, Gopal Kadekodi and Mary Gregory (1979) : Income Distribution, Growth and Basic Needs in India (Vikas Publishing House, New Delhi)

(b) Reports

7. Moreland R Scott, (1978) : A Demographic - Economic Model for Developing Countries: Bachue International (ILO, WEP 2-21/WP.70)

8. Mike Hopkins and Rolph Van Der Hoeven (1979) : Economic and Social Factors in Development: A Socio-Economic Framework for Basic Needs Planning (ILO, WEP 2-32/WP 197)

9. India: Occasional Papers(1978) : World Bank Staff Working Paper No.279

10. Report of the Working Group on Education and Manpower (1972) Planning for the Perspective Plan of Gujarat 1974-1984 : (Government of Gujarat, Planning Department, 1972)

11. Krishnayya, J.G., B Joshi, R Madhu, S K Sharma, and S Chatterji (1980) : Bachue-BN India Progress Report May 1980, SRI, Pune.

12. Krishnayya, J.G., K.N.S.Nair, B.Joshi, V Phaneendhrudu, S Chatterji (1980) : The India Basic Needs Model, an Interim Report, SRI, Pune.

13. The Constitution of India : Ministry of Law, Government of India.

14. Fourth Five Year Plan (1969) : Planning Commission, Government of India.

15. 28th Meeting of the National Development Council, Summary Record. : Planning Commission, Government of India

16. Sixth Five Year Plan 1980-1985 A Framework : Planning Commission, Government of India

17. Baji, C. (1975) : The Minimum Needs Programme: A Study on Social Development Policy, Centre for Policy Research, New Delhi.

18. Dandekar, K. (1980) : Tackling of Unemployment Problem Through Employment Guarantee, Round Table Conference on Employment, Indian Economic Association, Poona.

19. Lakdawala, D.T. (1980) : Redistributive Policies and Basic Needs in Indian Planning, Seminar on 'The Basic Needs Approach to Indian Planning', Trivandrum.

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

(c) Statistical Tables

21. UNESCO Statistical Year Book (1974)

22. Pocket Book of Health Statistics of India, (1978) (Ministry of Health and Family Welfare)

23. Census of India: General Population Tables (1971)

24. Census of India: General Economic Tables (1971)

25. Census of India: Social and Cultural Tables (1971)

26. National Accounts Statistics 1970-71 to 1975-76 (Central Statistical Organisation)

27. National Sample Survey: Twenty fifth round on consumer expenditure (1978), (NSSO, Ministry of Planning)

28. National Commission on Agriculture: Abridged Report (Ministry of Agriculture) (1976)

29. Statistical outline of India (1980) (Tata Services Limited, Department of Economics and Statistics, Bombay)

30. Statistical Pocket Book INDIA (1977) (Central Statistical Organisation)

Economic and Social Policy Synthesis Programme

WEP 2-32/WP 1	Altnerative Development Strategies and Basic Needs - by Franklyn Lisk and Diane Werneke, March 1976
WEP 2-32/WP 2	An Introduction to the Structure and Dynamics of Systems - by S.A. Kuzmin, September 1976
WEP 2-32/WP 3	Basic Needs Approach to Development Planning: A View - by Michael J. Hopkins, May 1977
WEP 2-32/WP 4	The Impact of Recent Economic Slowdown on the Employment Opportunities of Women - by Diane Werneke, May 1977
WEP 2-32/WP 5	WEP Models: Some Basic Features - by S.A. Kuzmin, June 1977
WEP 2-32/WP 6	Popular Participation in Planning and Decision-Making for Basic Needs Fulfilment: An Institutional Approach - by Jean Majeres, December 1977
WEP 2-32/WP 7	The Distribution of the Benefits of Growth: Basic Needs in the Philippines - by Richard J. Szal, January 1978
WEP 2-32/WP 8	Somalia and Basic Needs - Some Issues - by Michael J. Hopkins, January 1978
WEP 2-32/WP 9	Basic Needs Performance: An Analysis of some International Data - by Glen Sheehan and Michael J. Hopkins, January 1978
WEP 2-32/WP 10	The Contemporary Work Ethic in Industrialised Market Economy Countries - by David H. Freedman, March 1978
WEP 2-32/WP 11	Five Essays on the Basic Needs Approach - by Jean Mouly and S.A. Kuzmin, May 1978
WEP 2-32/WP 12	Popular Participation in Decision-Making and the Basic Needs Approach to Development: Methods, Issues and Experiences - by Donald Curtis, Kenneth Davey, Arnold Hughes and Andrew Shepherd, June 1978
WEP 2-32/WP 13	Meeting Basic Human Needs: Some Global Estimates - by Michael J. Hopkins and O.D.K. Norbye, July 1978

WEP 2-32/WP 14	Mass Participation and Basic Needs Satisfaction: The Chinese Approach - by Ng Gek-boo, January 1979
WEP 2-32/WP 15	The "Basic Needs" Approach to Development and the Significance of Third World Industrialisation - by Agit Singh, February 1979
WEP 2-32/WP 16	Basic Needs Satisfaction in ILO Member States - Presentation and Analysis of National Responses to a World Enquiry - by Torkel Alfthan, April 1979
WEP 2-32/WP 17	Household Surveys for Poverty Studies: Some Guidelines - by Samir Radwan and Torkel Alfthan May 1979
WEP 2-32/WP 18	Policy Inter-Actions within an Integrated (Basic Needs-Oriented) Development Strategy - by S.A. Kuzmin, June 1979
WEP 2-32/WP 19	Economic and Social Factors in Development: A Socio-Economic Framework for Basic Needs Planning (a contribution to the UN Third Development Decade) - by Mike Hopkins and Rolph Van Der Hoeven
WEP 2-32/WP 20	Meeting Basic Needs in a Socialist Framework The Example of Tanzania - by Rolph Van Der Hoeven, July 1979
WEP 2-32/WP 21	Problèmes et Perspectives de Développement Régional et Local au Maroc - by El Ghazouani Rachidi et Abdeljalil Agourram, July 1980
WEP 2-32/WP 22	Research and Action Programme for Least Developed Countries: Some Tentative Proposals - by O.D.K. Norbye
WEP 2-32/WP 23	Employment Alternatives in Global Development Scenarios. Part I: Dimensions of the Employment Problem in Developing Countries, 1970-2000 - by S.A. Kuzmin, October 1980
WEP 2-32/WP 24	Les Determinants de la Satisfaction des Besions Essentiels et leur Impact - par R. Rietschin sous la direction de F. Carlevaro, February 1981

WEP Research Working Papers are preliminary documents circulated informally in a limited number of copies solely to stimulate discussion and critical comment. They are restricted and should not be cited without permission. A set of selected WEP Research Working Papers, completed by annual supplements, is available in microfiche form for sale to the public; orders should be sent to ILO Publications, International Labour Office, CH 1211 Geneva 22, Switzerland. This list includes many, but not all, papers which exist or may be issued in microfiche form.