

CHAPTER VI

MACRO-MATHEMATICAL MODEL

Part One

6.1.1 INTRODUCTION

Unlike other chapters of this study, this chapter is divided into two parts. We have already seen in a previous chapter how low the paddy equivalent per acre in these rural economies is. The part one of this chapter is devoted to other appalling features of these lagging rural economies. There may be differences in the use of natural endowments in various areas of the country. Yet in each of these so much of improvement and expansion of output and employment is possible that political parties and general economists are unable to conceive.

6.1.2 ANALYSIS OF INCOME

We analyze the income and employment data of the villages surveyed to have idea of the massive efforts required to usher in full employment and, in stages, seek to raise the value of this full employment through rounds and rounds of re-investment in newer activities and matching institutional reforms and infrastructures and move to successively higher peaks of efficiency.

As we take up the income data first, it is in order to consider the fundamental identity of GDP or GNP :

$$C+I+G + (X-M) = GDP = C+S+T+R. (I).$$

The symbols here have their usual meaning, namely,

C = Sum of Consumption expenditure

I = Sum of investment expenditure

G = Government purchases of goods and services

(X-M) = net exports of goods and services

[X = exports; M = imports]

S = Gross private saving (business saving + personal saving
depreciation)

T = net tax revenues [tax revenue – (domestic transfer payments + net
interest paid + net subsidies)]

R = private transfer payments to foreigners.

Now excluding the foreign sector, the identity turns into

$$C+I+G = Y = C+S+T,$$

$$Y = \text{GDP} \dots\dots\dots \text{(II)}$$

We may deduct capital consumption allowances from I to determine net investment and from S to find net private saving. *Identity II* becomes an identity $Y = \text{NNP}$.

Then when we evaluate C and net I and G at factor prices, deducting IBT (indirect business taxes) from both sides of the identity, *Identity II* becomes an identity for $Y = \text{NI}$.

All income data and figures here under are annual. We present first four tables.

Table 6.I.1

Distribution of Annual Income of Earners (Males)

Income (Rs. In Hundreds)	Midpoints	Frequency
20 – 29	24.5	29
29 – 35	32.0	31
35 – 43	39.0	30
43 – 47	45.0	30
47 – 52	49.5	29
52 – 60	56.0	30
60 – 72	66.0	31
72 – 92	82.0	30
92 – 100	96.0	31
100 – 600	350.0	27
Total		298

Table 6.I.2

Distribution of Annual Income of Earners (Females)

Income (Rs. In Hundreds)	Midpoints	Frequency
14 - 20	17	4
20 - 30	25	4
30 - 50	40	4
50 - 60	55	4
60 - 80	70	4
80 - 100	90	4
100 - 140	120	4
140 - 160	150	4
160 - 200	180	5
200 - 360	280	3
Total		40

It can be seen from tables 6.I.1 and 6.I.2 that the highest average income of the highest group is Rs. 35,000. Even though it represents the group of the highest income earners, an earner, especially a good earner in these rural economies, earns for all his family members and the family size is often high for; the better earners. Consider the family size is 6. Then, the per capita

income in the family becomes Rs. 5,831 only. In terms of dollar this roughly turns out to be US \$ 116. If inflation accounting is done properly in geographically big countries

Table 6.I.3

Distribution of Annual Family Income

Family Income (Rs. In Hundreds)	Midpoints	Frequency
30 - 50	40	18
50 - 70	60	19
70 - 90	80	18
90 - 110	100	19
110 - 120	115	17
120 - 140	130	18
140 - 160	150	17
160 - 180	170	19
180 - 200	190	17
200 - 480	340	18
Total		180

then this dollar income equivalent is quite low enough for the upper sector of income earners.

Table 6.I.4

Distribution of Per Capita Annual Income in the Family

Per Capita Income of the Family (Rs. In Hundreds)	Midpoints	Frequency
6 - 10	8	18
10 - 12	11	19
12 - 14	13	17
14 - 16	15	19
16 - 18	17	18
18 - 20	19	17
20 - 22	21	18
22 - 24	23	19
24 - 30	27	18
26 - 34	30	17
Total	-	180

When we consider the distribution of annual family income, as presented in table 6.I.3, and distribution of per capita annual income in the family, as presented in table 6.I.4, the picture becomes even more concrete.

The average family income in the highest group is Rs. 34,000 only. Taking again family size as 6, the per capita income in the family in the highest group may be computed as 113 dollars. In our judgement the entire village population may be considered as staying below the poverty line. Especially because the super high potential of productivity of land endowment coupled with the potential for raising the productivity and skill of labour, it is strange that such appalling income picture of our lagging rural economies did not so far raise the concern of responsible patriots.

Of the two tables mentioned in the preceding paragraph the last one appears as the sharpest. Here families are ordered according to per capita annual income in the family. We notice from this table viz., table 6.I.4, that the average highest per capita income in the family for the highest group is Rs. 3000 only. The dollar equivalent is 60 dollars per annum. So our conclusion to treat the people struggling in these rural economies as below the poverty line gets strengthened, more than adequately.

To complete this analysis of income, we present three figures of dual concentration curves. In figure 6.I.1 we have concentration curves of annual income of earners for males and females separately. These curves stress the measurement of inequality only. The inequality is shown as larger in the case of females. In the figure 6.I.2 we find that the inequality is larger in the case of family income than in the case of per capita income in the family. This is consistent with our discussion on the different sorts of measurements of annual incomes. We have already found on the basis of table 6.I.4, that this table detailing the per capita annual income in the family is the sharpest of all income tables. On the basis of the figure 6.I.2 we get the further support that the villagers are more equally poor when we consider the per capita annual income in the household.

The step by step analysis of income leading to the proof that people living in these rural economies are living below the poverty line naturally raises multiplicity of questions about their employment.

Figure - 6.I.1

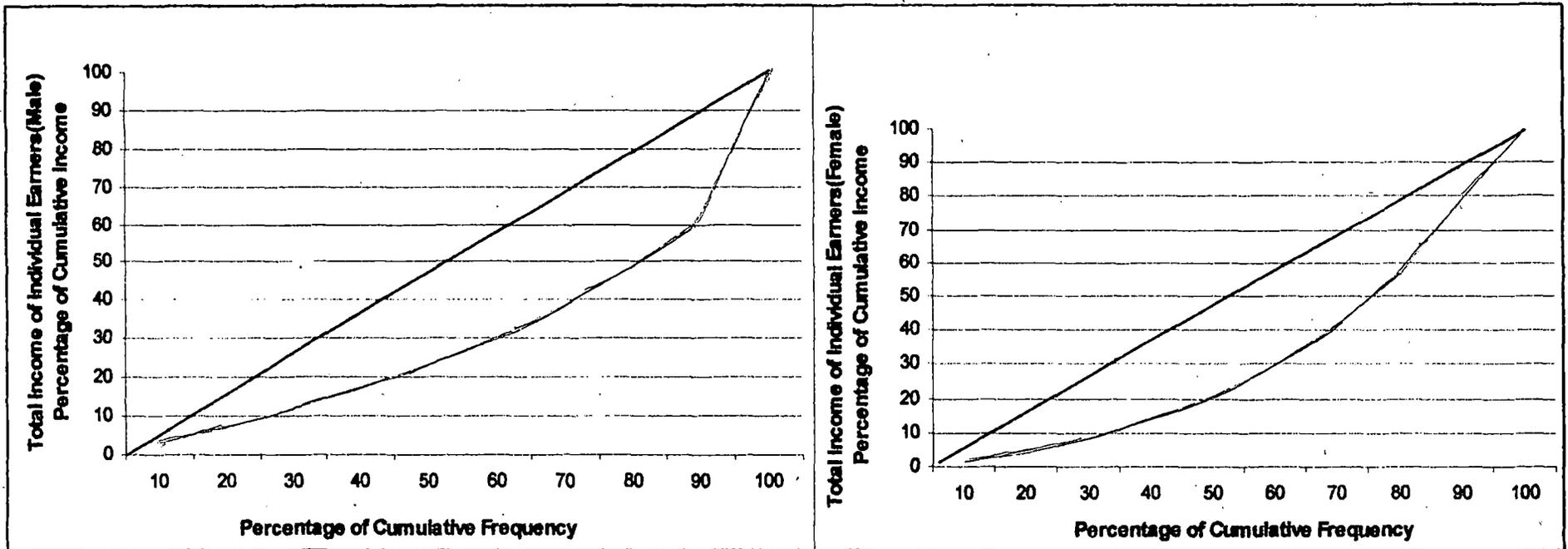


Figure - 6.I.2

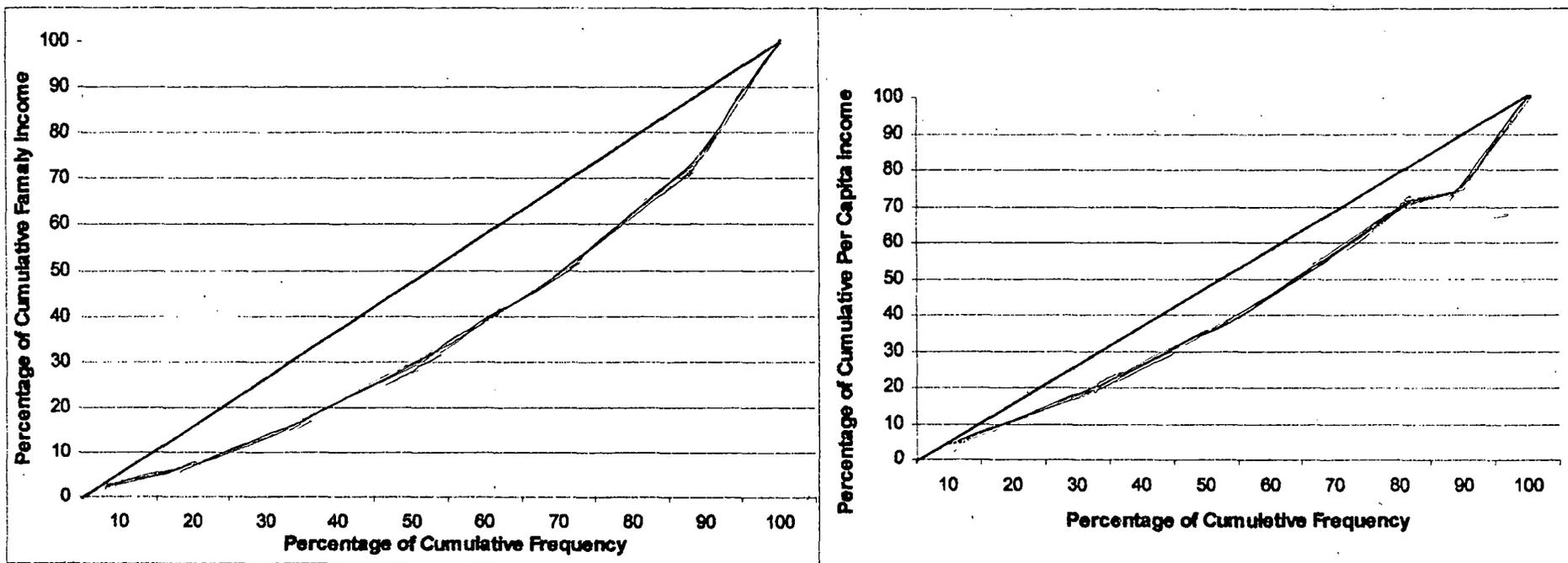
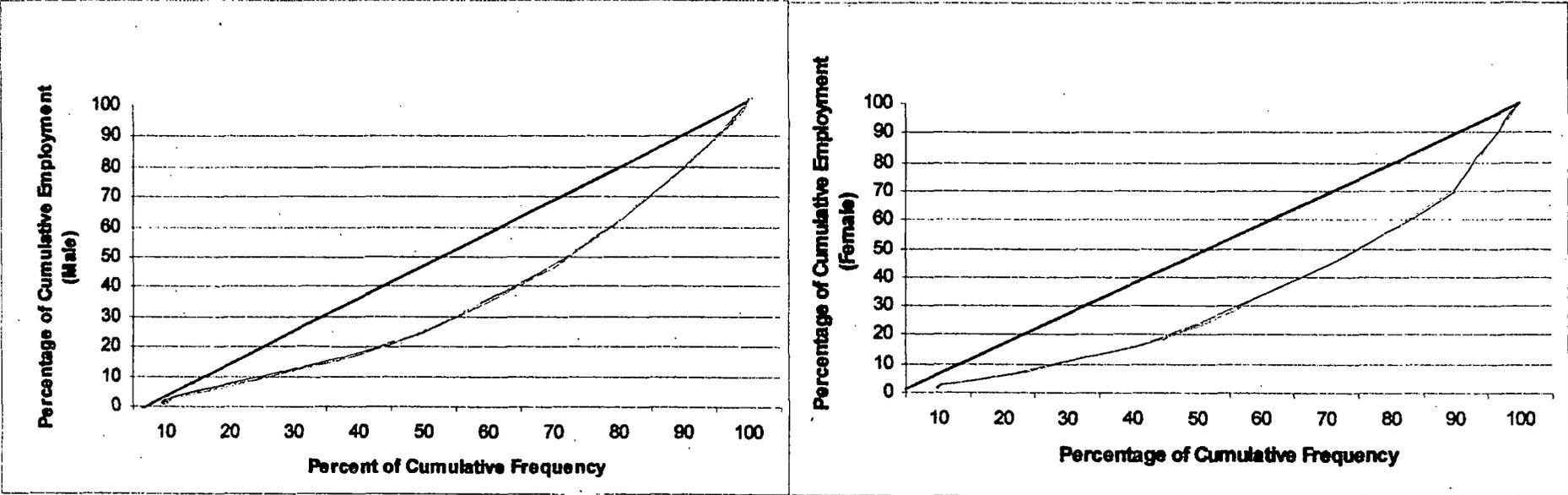


Figure - 6.I.3



6.I.3. ANALYSIS OF EMPLOYMENT

Table 6.1.5

Distribution of Man days of Employment
(Males)

Man days of Employment	Midpoint	Frequency
10 - 40	25	31
40 - 60	50	34
60 - 70	65	31
70 - 80	75	29
80 - 100	90	31
100 - 140	120	33
140 - 160	150	29
160 - 200	180	33
200 - 250	225	30
250 - 300	275	29
Total		310

As for reporting on unemployment, under-employment and low-value employment, we present two tables, one giving distribution of man days of employment of males and the other giving distribution of man days of employment of females. Thus table 6.I.5 gives the distribution of man days of

persons
 employment of males. ~~Persons~~ who have not completed 15 years of age are not included in this table.

Among the males 29 persons are wholly employed throughout the year in regular services. Of them 10 are school teachers. The rest are officials in the government, panchayat, gramin bank, settlement office, post office and medical units. Of the female, employed persons only four may be treated as employed for the whole year. Two of them are in teaching and the other two make bidis round the year. Excluding these males and females fully employed persons, we make rough computation of the total number of man days (male as well as female) employed in the rural productive activities. A very small portion of these man days may be employed in work outside rural productive activities. But this may be neglected for calculating the man days required by the rural productive process.

For calculating the number of man days employed in present rural productive processes we multiply the midpoints of intervals of man days of employment by the corresponding frequencies and then sum the products. We certainly ignore the highest group in each of the tables, because the persons covered are treated as fully employed (outside rural productive activities. On calculating we find that in total 32,415 man days from males and females are used by the rural productive activities now being run in the villages. If we regard employment for 160 days as reasonable full employment then roughly 203 persons can be given full employment. But currently 315 persons of men and women share these employment opportunities offered in the villages. But granting that with freedom of operators more-efficient people will be given more than average full employment it is even possible that of the 315 persons who are in some sort of employment under rural enterprises are mostly miserably under-employed. Besides, we can see from table 6.I.7 and table 6.I.8. 6.I.8 actual number of males and females of persons 15 years and above and classification of persons of 15 years or more according to educational status as described in table 6.I.8.

Table 6.1.6

Distribution of Man days of Employment
(Female)

Man days of Employment	Midpoint	Frequency
10 – 20	15	4
20 – 30	25	4
30 – 40	35	4
40 – 50	45	3
50 – 60	55	4
60 – 70	65	4
70 – 80	75	4
80 – 90	85	4
90 – 180	135	3
180 – 300	240	4
Total		38

Table 6.I.7
Age Sex Distribution of Persons 15 Years or More

Age	Male	Female	Total
15 – 35	144	130	274
35 – 60	190	170	360
Above 60	32	20	52
Total	366	320	686

Table 6.I.8
Educational Status of Persons 15 Years or More

Status	Male	Female	Total
No Schooling or below 6 Years	25	22	47
6 Years of Schooling	24	22	46
Above 6 Years but not Passing Secondary	28	20	48
Secondary and Higher Secondary	94	54	148
Post Higher Secondary	10	4	14

We have also known that 90 per cent of women who are 15 years or more are willing to accept any full time paid work and at least 50 males who are not sharing any employment under rural enterprises now are willing to

accept any work under rural household productive activities. Thus another (258 women + 50 men + 112 persons in some sort of employed but considered surplus) or 420 completely unemployed males and females are to be given full employment. So we see of the available persons of 653 persons, 430 persons are completely unemployed. That is to say ^{more than} ~~about~~ two-thirds of employments seeking persons are unemployed even at generally low value full employment. So demand for full work demands massive production plan for the countryside. Fortunately our land endowment and resources have enormous promise for great employment potential. Only thing to stress is that we must be up and doing for great plan and great reforms for implementing higher output and employment in every stage without cessation. It is time that since a minority are getting better employed under household enterprises a vast majority of those enjoying employment in household productive activities are having too low-value employment.

This need not dampen us, because with correct planning, proper reforms and matching infrastructural facilities it is even possible to shift the main productivity centre from towns to villages, because technicians and experts may move to countryside to enrich the professional management of cooperatives.

Part Two

6.II.1 INTRODUCTION

The massive unemployment and utterly low value employment and underemployment in the midst of highly valuable land and natural endowment, (including climate) undoubtedly call for massive programme of production and employment. The areas from the activities of which these data come, represent one of the richest land endowments of the country and we have already introduced, the discussion of take off in these areas on the basis of a lead sector of milk and milk processing. We take the stand that our country is truly rich in respect of land resources and on the basis of local climates we shall find one or the other lead sector in respective areas. The inter-area division of labour among different areas of this vast country would, as we stated in the course of the preceding discussion, would go a long way to our true discovery of what agricultural and industrial goods we eventually excel in.

6.II.2. TABLEAU ECONOMIQUE

With a view to devising a method to usher in massive production, employment and efficiency and productivity heightening programme we fit a 'Tableau Economique' on the basis of data collected in a time-restricted work-budget. It is of first importance to acknowledge immediately that to fit a tableau of this type or input-output table or inter-industry accounts fed with data with any respectable accuracy is difficult as it needs a great deal of specialist knowledge and a team well-trained for the purpose. We can cite Leontief's estimate of India's national efforts in the sixties in respect of a countrywide input output table by P.C. Mahalanobis, whose contributions in the field of pure statistics and statistical organizations are unique in the world. Indian Statistical Institute and under its influence the Statistics Department of the University of Calcutta have been well known in the world for producing

some of the greatest Statisticians of the world. P.C. Mahalanobis has also been the founder of three most important statistical organizations in India. They are : (1) Indian Statistical Institute; (2) Central Statistical Organization, and (3) National Sample Survey. But, as far as we know, as yet no organization or bureau of the Central Government exists that is fully fit to collect the data for compiling a national input-output table in intervals of a number of years. Precisely for this lack of an organizational arrangement to compile a 'Comprehensive, detailed and quite accurate' national input-output table for our country, Leontief commented in his 1963 article entitled 'The structure of development' in the Scientific American that 'Others, having just entered the field, have not yet advanced beyond rather sketchy compilations of limited accuracy.' Perhaps Leontief received some copies of mimeographed working papers produced in the Indian Statistical Institute cited by Hollis B. Chenery and Paul G. Clark in their chapter on 'A survey of inter-industry research' of their book - Inter industry Economics published by John Wiley & Sons, New York, in 1959.

Under this circumstance, what is being presented here as an input-output table for a set of small villages which are among the most undeveloped of the world has certain special points to count. Of the three blocks we have surveyed, the input-output table being presented here, is constructed of the data of one of the blocks only. Incidentally, this block is the best of the three blocks in respect of activities. Firstly, no one has sought to compile an input-output table in these types of rural economies. Secondly, Leontief kind of input-output table of a set of villages can be a time consuming special subject of study, whereas this is, in this dissertation, only a part of a set of a number of quantitative studies bearing on the planning of the milk economy in the districts of the North Bengal Division of the state of West Bengal. Therefore, a gap in the collection of one important item causes the exclusion of an important item elsewhere in the table. The impossibility of tabulating net investment figures for different activities has caused the abandonment of figures of capital in the primary inputs. Thirdly, we have not included land as a natural resource because of the

fact that land's properties as an agent of production in special sectors depends on putting in resources into the land. Fourthly, while figures on net investment in enterprises, however small, are found positive, degradation of land does occur because of, among other things, absence of crop covers throughout the agricultural year. We have, however, made no attempt to deduct the loss, if any, of the land resource. Fifthly, the exports have been entered into and included in the figures for final uses, whereas a row has been used for recording the values of imports. Since the villages covered are not sovereign it needs to be investigated how much of these imports make up imports for the country as a whole. It has not been possible to do so and consequently to divide each of the imports and exports into two to indicate clearly the values of imports into the country and export from the country. As a result of this want of distinction of two types of each of imports and exports, what we find is that the balance of trade of this set of villages is balanced.

We also present another variation of the input-output table on the basis of which also solution for the total output for targeted final demand and import too can be found.

6.II.3 INPUT OUTPUT TABLES

Despite these limitations, the input-output table that we compile here is being developed as a basic input-output model and might throw considerable insights for further action for determined planning in stages for these villages in particular and for our countryside in general. We have divided the productive activities of the villages into four broad activities, namely, agriculture or production of crops, animal husbandry or output from animals mainly from HYV cows, irrigation and non-agricultural productive activity. Even though one particular activity may have non-homogeneous commodities, but their values are added together and the combined output in value terms is treated as the given product. This is also true of non-agricultural productive activities. But in the other two sectors the commodities are, more or less, homogeneous.

Table 6.II.1
Leontief Input Output System
(First Adaptation)

Supplying Sector Purchasing Sector	Intermediate Use			Final Use	Total Supply
	Sector 1 j n				
1 ⋮ i ⋮ n	z_{11}	z_{1j}	z_{1n}	Y_1	Z_1
Supplying Sector	z_{i1}	z_{ij}	z_{in}	Y_i	Z_i
n	z_{n1}	z_{nj}	z_{nn}	Y_n	Z_n
Primary Inputs (Valued added)	V_1	V_j	V_n		
Imports	M_1	M_j	M_n		
Total Supply	Z_1	Z_j	Z_n		Z

Table 6.II.2
Input Output Table
(First Adaptation)

Supplying Sector \ Productive Sector	Agriculture	Irrigation	Animal Husbandry	Non Agricultural production	Final uses	Total supply
Agriculture	85,618	-	139,592	5,000	1261,471	1491,81
Irrigation	33,000	-	-	-	2,000	35,000
Animal Husbandry	46,429	-	-	20,000	516,919	583,348
Non Agricultural production	-	-	13,541	18,000	513,459	545,000
Primary Inputs (Value added)	1200,000	32,000	270,215	452,000	-	-
Imports	126,634	3,000	160,000	50,000	-	-
Total supply	1491,681	35,000	583,348	545,000	-	2655,029

Table 6.II.3
(On First Adaptation)
Input-Output Co-efficients

Supplying Sector \ Productive Sector	Agriculture	Irrigation	Animal Husbandry	Non Agricultural production
Agriculture	0.06	0	0.24	0.01
Irrigation	0.02	0	0	0
Animal Husbandry	0.03	0	0	0.04
Non Agricultural production	0	0	0.02	0.03
Primary Inputs (Value added)	0.80	0.91	0.46	0.83
Imports	0.09	0.09	0.28	0.09
Total supply	1.00	1.00	1.00	1.00

Table 6.II.4
Leontief Input Output System
(Second Adaptation)

Supplying Sector \ Purchasing Sector	Intermediate Use			Households	Total Output	
	Sector					
	Ijn			
Supplying Sector	i	X_{i1}	X_{ij}	X_{in}	Y_i	X_i
					
	i	X_{i1}	X_{ij}	X_{in}	Y_i	X_i
.....						
n	X_{n1}	X_{nj}	X_{nn}	Y_n	X_n	
Households	V_1	V_j	V_n	Y		
Total Output	X_1	X_j	X_n		X	

Table 6.II.5
Input Output Table
(Second Adaptation)

Supplying Sector \ Productive Sector	Agriculture	Irrigation	Animal Husbandry	Non Agricultural production	Final uses	Total output
Agriculture	85,618	-	139,592	5,000	1261,471	1491,81
Irrigation	33,000	-	-	-	2,000	35,000
Animal Husbandry	46,429	-	-	20,000	516,919	583,384
Non Agricultural production	-	-	13,541	18,000	513,459	545,000
Households	1326,634	35,000	430,215	502,000	2293,849	-
Total Output	1491,681	35,000	583,348	545,000	-	2655,029

These beginnings with the compilation of input output table are important. Special or general solution might be used for estimating requirements for total output and other magnitudes on the basis of targets of final demand. But with the present level of institutional arrangements the continuous increase of production in these lagging rural economies is not possible. If it were possible, these lagging rural economies would not have been in this shape. So we take up in the eighth chapter the institutional reforms and planning requirements for expanding growth in the countryside.

With the institutional reforms carried out, we shall be in a position to carry out special and general solution of this type of input-output models in different years, monitor further improvement of the models and seek integration with different regions of the country and the neighbouring foreign economies with whom we can have the minimum of transport costs.

— SUMMARY OF THE CHAPTER

On analyzing the income data we find that all families living in these lagging rural economies are considered by us as living below the poverty line. Similarly, on analyzing the employment data of males and females we find that we have the immediate need of providing full employment to double the number of those who may be treated as being in full employment. That means that the present level of rural productive activities can give some sort of a full employment to only one third of those who need full employment on a very modest average value of employment.

We conceive Leontief type of macro-mathematical model to deal with the challenge of low employment and low income.