SOME EXERCISES IN POLICY ANALYSIS USING A SAM AND A MACRO MODEL

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I hereby affirm that the research for this dissertatiion titled "Some Exercises in Policy Analysis Using a SAM and a Macro Model" being submitted to the Jawaharlal Nehru University for the award of Master of Philosophy in Applied Economics was carried out entirely by me at the Centre For Development Studies, Trivandrum.

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Certified that this dissertation, the bonafide work of Sri Anil Mascarenhas, has not been considered for the award of any other degree by any other University.

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CHAPTER ONE

INTRODUCTION

Macro modelling efforts for the Indian economy had, until 1981, been largely centred around building econometric models. However, these models have not been very successful for answering questions regarding developmental issues of the Indian economy in the way of simulating macro forecasts under alternative assumptions of the key structural variables and policies.

In building a macro model of the Indian economy one has to- if the model is to be useful for policy makers- account for the developmental aspects more specifically. In other words, the models should essentially be planning models. Three lines of research captured the attention of economists in the 1970s. One was the organisation and analysis of national accounts data in terms of a social accounting matrix or SAM. The second was the construction of elaborate computable general equilibrium models (CGE) models based on data summarized in the SAM. The third was the realization that most of the economic content of the CGE models could be captured by simple limited sector analogs based on general economic structure as described by Keynes and Kalecki.

The use of CGE models for policy analysis has become widespread for both developed and developing economies. Most of the applications for developed economies have focussed on microeconomics with the analysis concentrating on estimating the welfare impact of alternative tax structures or energy policies. In developing countries CGE models have been used for a wider

range of issues from medium to long-term macroeconomic policy analysis to the more traditional microeconomic issues analyzed in developed countries as well. CGE models have been used frequently for medium to long-term policy analysis in developing countries. The policy applications have ranged from long-run issues such as the impact of alternative development strategies on growth and resource allocation or on policy concerning exhaustible resources to medium-run issues such as rural-urban migration, labour markets and employment, the functional and size distribution of income, and tax reform.

The use of CGE models in macromodelling the Indian economy has resulted in works by Mohan (1984), de Janvry and Sadoulet (1986), Taylor et al (1984), Gupta and Togan (1984), Blomqvist and Mohammed (1986), Narayana et al (1987).

It is important to note that CGE models rely on the social accounts framework and the social accounting matrix (SAM) to capture national income and product as well as input-output information. The relationship between CGE models and SAMs is made possible through the one fundamental law in economics that for every income there is a corresponding outlay or expenditure. This law plays an important role in defining the completeness of a model or analytic formulation. No theory or model can be correct unless it is complete in the sense that all incomes and outlays are fully accounted for. A social accounting matrix is a simple and efficient way of representing this fundamental law. The SAM approach that follows from it is a way of addressing problems or issues in economics that starts out by setting the problem within the framework of a social accounting matrix.

To elaborate further, it must be noted first that a SAM is a

square matrix designed to provide a record of transactions using a single-entry form of book-keeping. It can be represented as

$$T = (t_{jk}) \ldots\ldots\ldots 1.$$

and is structured so that each transactor or group of transactors that needs to be considered in relation to some particular issue has its own row and column in the matrix. These rows and columns are identically ordered. By definition, there must be two sided to every transaction and, by convention, receipts of transactions j are entered in row j of the SAM, and expenditures by k are entered in column k. Hence, by following this convention, t_{jk} is the value of all receipts of j from k during the accounting period. Correspondingly, t_{kj} measures payments to k by j.

Two things now follow. First, T must be a square matrix, as each transactor has its own row and column.Second, corresponding row and column totals of T must be equal.

This second restriction can be written as

$$T_i = y = Ti \ldots\ldots\ldots 2.$$

where i is a summation vector so that the jth element of y (y_j) is the sum of both all elements in the jth row of T (Σt_{jk}). Thus y_j is both the total income and the total outlay or expenditure of transactor j. The two must be equal because, according to the law stated above, for every receipt and, hence, for each transactor's total income there must be some matching expenditures or outlays that are equal in aggregate to the total income. In other words, the fundamental law is satisfied only if the second condition is satisfied.

Since every economic model has its corresponding accounting framework, and since every such framework can be set out as a SAM, it follows that every economic model has a corresponding SAM

which will satisfy condition two if the model is correct in the sense that it satisfies the fundamental law. Accordingly, condition two provides the initial link between SAMs and models. The macroeconomic model used in this study for the analysis of the effects on income distribution of various government policies is also founded on a SAM, that for India for the year 1980-81.

Objective of the Study

The objective of the study is to examine the effects of various kinds of government policies on the functional income distribution in India.It is intended to observe how the shares of agricultural income, wage income and profit income behave under different macroeconomic policy regimes. The various policies may be grouped as expansionary policies and deflationary policies. Those that fall in the first category are increases in investment,increases in exports and balanced budget policies. Those policies that are examined in the second category are increases in imports.

The analysis is conducted within an adapted version of Lance Taylor's model of short-run adjustments in the Indian economy. The data base for the model is structured in the form of a social accounting matrix (SAM) and it is around the SAM that the model is built.The model equations are parameterized in such a way as to satisfy the SAM.

Outline of the Study

The study is organised as follows:

Chapter Two gives an introduction to social accounting matrices, their origin, background and purpose. It also explains the structure of the SAM and discusses its applications and uses.

Chapter Three discusses macroeconomic modelling,tracing the evolution of econometric models, their role in policy analysis in India and the issues to which they have been applied.Some of their shortcomings are also highlighted in the Indian context.

Chapter Four presents the analysis of this study, outlining the analytical model used and also its data base, the SAM for India (1980-81).Various kinds of policy experiments are conducted and their results and interpretations discussed.

Chapter Five summarizes the study,highlighting the major findings of the analysis.

CHAPTER TWO

SOCIAL ACCOUNTING MATRICES

2.1 Background

Since the early 1970s there has been considerable interest and momentum in the design, construction and use of social accounting matrices (usually referred to as SAM) in developing countries. Certainly, the matrix representation of the accounts and transactions within the economy is far from being a new concept.It is an integral part of the United Nations System of National Accounts (SNA,1968), a national accounting system which is extensively referred to throughout the world. Nevertheless, most of the credit for generating this momentum and for redirecting research energies in this way is due to Graham Pyatt, although he would accredit as much to Sir Richard Stone, perhaps the main protagonist of accounting matrices and the principal architect of the SNA. The case for SNAs as an approach to macroeconomic data systems and their special appeal for the statistical needs of developing countries is very strong. Previous works, incorporating the use of a SAM, include a short monograph setting out the main arguments for the SAM approach in the context of development planning (Pyatt and Thorbecke,1976), a comparison of three early case studies for Sri Lanka, Iran and Swaziland (Pyatt and Round,1977); a detailed account of the SAM for Sri Lanka (Pyatt et al,1977); and a most comprehensive SAM for Malaysia which is briefly surveyed in Chander et al (1980). A

dozen or more case studies plus related analytical work were presented at a conference in Cambridge, U.K, in 1978, attesting to the growing interest in SAM as a data framework for development planning. The SAM framework is not just a statistical tool:it is also a framework for economic analysis. Work by Bell and Hazell (1976) demonstrates this point in relation to a regional development scheme. Also, the SAM approach has been used as a framework for exploring planning alternatives involving huge structural change in Saudi Arabia.The essential point, therefore, is that SAM is not the preserve of the statistician but a potential bond in common with the economist.One overall effect of extending and displaying a set of national accounts in the format of a social accounting matrix is that flows within and between various parts of the economy can be recorded and followed through according to the processes that actually occur in the flux and flow of economic activity.

2.2 Purpose And Origin Of The SAM

Social accounting is an evolving technique for data organization, reconciliation and descriptive analysis of the structure of the economy for the time period of the data. The social accounting framework can also serve as a basis for macro-economic modelling. A number of SAMs have been constructed for various economies, each providing new insights and findings into how the principle of this tool can be applied in different situations. In the last decade several well-documented SAMs have been compiled, focussing on distribution issues and institutional

organization of economies. These include the SAMs for Sri Lanka (Pyatt and Roe,1977), Malaysia (Pyatt and Round,1984), Iran (Pyatt,1975).

As a data system social accounting reflects the institutional structure of the country under consideration and is concerned with major macroeconomic and distributive issues of the country to which it is applied. Since countries differ in their level of development, structure of the economy, organization and institutions, the implementation of social accounting principles also differs with each application. The origin of the social accounting approach to macroeconomic systems was developed in the U.N System of National Accounts (SNA, UNSO,1968). The emphasis of the S.N.A has been on the structure of production in an economy, largely disregarding institutional, social and distributional issues. The recent development of SAMs in developing countries by Pyatt and associates and other subsequent work have, on the other hand, concentrated on flows and distribution of incomes and expenditures between the major institutional participants in an economy. In essence, a social accounting matrix is a consistent data system that provides comprehensive one period information on such variables as 1. the structure, composition and level of production 2. the factoral value added and 3.the distribution of income among household groups. Typically, a SAM is structured around an input-output table, and includes summary statistics on consumption and production patterns, exports, imports, investment and savings. Depending on the particular issues of interest and the data available a SAM may include more detailed information on income distribution, tax structure and monetary variables. The focus of the SAM may be either on the analysis of the production

structure, household income distribution, monetary flows or, among others, on the analysis of the public sector. The most important feature of a SAM is that it provides a consistent and convenient approach to organizing economic data for a country and it can provide a basis for descriptive analysis and economic modelling in order to answer various economy policy questions.

2.3 Structure of the SAM

Historically, the design of a statistical information system as a social accounting matrix has evolved from the combination of two ideas; the matrix presentation of national income accounts, reflecting the Keynesian model of the market for goods and services, and the input- output model of the structural interdependence of production in the economy. The Keynesian model divides economic activity into three categories : production, income and expenditure; and accumulation. The following table, Table 1, below, shows these aspects of a closed economy in a simple social accounting matrix (SAM) framework which serves to illustrate two basic rules for understanding such matrices. These are 1. for every row there is a corresponding column and the system is complete only if the corresponding row and column totals are identical;

2. every entry is a receipt when read in its row context and an expenditure from the point of view of its column.The description of social accounting matrices as simple entry accounts derives from this rule.

In Table 2.3.1 the production accounts are divided as between

TABLE 2.3.1 An Aggregated Social Accounting Matrix (SAM)

	Production accounts		Institution accounts		
	Production activities	Factors of production	Current	Capital	Total
	1	2	3	4	
1 Production Activities	*	0	Consumption expenditure	Investment expenditure	Final Demand
2 Factors of Production	Value added	0	0	0	National product
3 Current	0	Factor Payments	*	0	National Income
4 Capital	0	0	Savings	*	Savings
5 Total	Domestic product	National income	National expenditure	Investment	

Source: Pyatt,G and Roe, A.R,(1977). Social Accounting for Development Planning with Special Reference to Sri Lanka,(London: Cambridge University Press,1977), p.41.

the accounts of production activities which generate value added; and factors of production, which provide primary services employed by production activities. Column 1 of the table shows the cost structure of production activities. The first element is shown as an asterisk. It represents money flows from production activities to production activities. It is therefore a transfer payment between production activities and as such does not enter into national income. The second item in the column is value added by production activities, which goes as a payment to the factors of production, i.e to capital, labour and other resources. Production activities have no transactions with institutions as such, so all other items in the column are zero. The column total (excluding transfer payments) is therefore the

sum of value added in production activities, i.e the domestic product.

The second row of Table 2.3.1 shows that value added is the sole source of income of the factors of production. The second column shows how this is paid out : it goes to the current account of institutions, i.e to households, companies and government. Institutions are defined as having the legal right of ownership. Accordingly, only they can accumulate and only they can provide the services of factors of production. Since they provide the factor services they receive value added in the form of factor payments, i.e wages, salaries, rent and profits.

Column 3 shows how institutions spend the national income. For the most part they buy goods and services provided by production activities for consumption. What they do not spend in this way, by definition they save.

Finally, because institutions are the only bodies with the legal right of ownership, only they can save and accumulate. There may be capital transfers between them (known as flow - of - funds), but these net to zero. Total savings must be spent, therefore, on capital goods. Thus,in row and column 4 savings equal investment expenditure, which represents a further source of income for the production activities which provide the capital goods.

TABLE 2.3.2 An Aggregated input-output system

	Production	Final Demand	Total
Production activities	Interindustry transactions	Consumption plus investment	Gross outputs
Factors of Production	Value added		
Total	Gross outputs		

Source:Same as above,p.42.

In contrast with the national income accounts, the input-output model of the structural interdependence of production in an economy has an information system such as that shown in Table 2.3.2, which is again restricted to the simple case of a closed economy. As is immediately obvious from the table, it is not a regular (square) SAM but is, rather, inverted L- shaped, concerned with only two alternative ways of accounting for the gross outputs of production activities. From the revenue or demand point of view and therefore reading across the row gross output comes from inter- industry transactions and final demand. The latter is simply consumption and investment expenditure while the former is the set of transfer payments between production activities which were ignored in the SAM presentation of Table 2.3.1. Accordingly, the information in the row of Table 2.3.2 is the same as that in row 1 of Table 2.3.2 except that the inter-industry transfers are no longer omitted. The column of Table 2.3.2 has exactly the same relationship with the first column of Table 2.3.1. It follows that the two information systems can be combined by including inter-industry transfers in Table 2.3.1 Because they lie on a diagonal of Table 2.3.1 they do not upset

the balance of rows and columns in that table. These same remarks apply equally to other transfers so that we may generalize Table 2.3.1 further by making both current and capital transfers between institutions explicit in the table as well as transfers between production activities. This leads to the SAM format in Table 2.3.3 below, which, like Table 2.3.1, has the property that each row sum is the same as the corresponding column sum.

It is apparent that Table 2.3.3 contains more information than Table 2.3.1. The question is whether this information is useful. The answer is 'no' if we are interested only in national income because in that context the inter-industry and inter-institutional transfers net out. However, input- output analysis is directed towards identifying the size of aggregates but is concerned with the relative size and interdependence of different sorts of production : it helps to answer questions posed at the disaggregated level, not the aggregate level. For example, it asks what must be the structure of production in relation to a given structure of final demand, and what will be the pattern of prices given the primary costs of each production activity. Similarly, current transfers between institutions give information on their relative incomes , while capital transfers reflect the structure of savings and investment. these structural / distributional questions are irrelevant to a concern for national income aggregates. However, they are obviously of great interest from the point of view of understanding how any economy works. Hence, the extra information in Table 2.3.3 is of considerable value.

TABLE 2.3.3: An Aggregated Social Accounting Matrix Embracing Input-Output Transactions

	Production accounts		Institution accounts	
	Production activities 1	Factors of Production 2	Current 3	Capital 4
1 Production activities	Interindustry transactions	0	Consumption expenditure	Investment expenditure
2 Factors of Production	Value added	0	0	0
3 Current	0	Factor Payments	Current transfers	0
4 Capital	0	0	Savings	Capital transfers

Source:Same as above, p.43.

2.4. Purposes of The SAM

As indicated above, SAMs can serve two basic purposes. First, they can be used to strengthen capabilities of a particular country to organize and reconcile its statistical data from different sources to obtain a descriptive picture of an economy presenting its institutional features, income distribution picture, and the industrial structure. The descriptive analysis based on the SAM is usually concerned with the picture of the economy for the time period of the data. For example, such an analysis attempts to estimate what have been the income distribution and expenditure patterns for different social groups in a given year, the level of imports, exports, savings, the tax revenues, production level, transfers, current account deficit and so on.

The second purpose for which the SAM approach can be

used is for the organization and analysis of data. The SAM approach,in the first instance, helps to organize statistical information that is usually scattered and documented in various publications into one single piece of information. Because of its consistency properties, it forces the analyst to reconcile different sources of inconsistent information.In addition, because of the economy-wide framework of the SAM several indicators about the public sector can be derived and analyzed using a relatively simple methodology. For example, the comparison of the two sectors, public and private, and of the public sector with the economy as a whole is made easier after the SAM has been built.

2.5 The Use Of The SAM For Macroeconomic Model Building

So far, we have seen the usefulness of the SAM framework for descriptive analysis of the structure of the economy and organization of statistical data. The SAM framework, however, can be looked at from a different perspective by using it for the purpose of macroeconomic modelling. Two different types of macro models which utilize SAM as an accounting framework can be built: linear general equilibrium multiplier models and non-linear general equilibrium models. These models differ primarily in their underlying assumptions about the structure of an economy. However, non-linear general equilibrium have much greater computational requirements and need more data inputs than the linear multiplier models.

The multiplier analysis in the SAM framework is conceptually

similar to input-output analysis. Like input-output analysis, it estimates the effects of one- time increases in exogenous variables (injections) on endogenous variables in the accounting framework. It is used primarily for short- term policy analysis. The accounting framework becomes a modelling structure with the partitioning of the SAM matrix into blocks of endogenous and exogenous accounts. Assuming that the underlying structure that determines the endogenous accounts remains unchanged it is possible to develop a model based on the assumption of fixed input- output coefficients. It is then possible to calculate the changes in the flows presented in the SAM due to changes in exogenous accounts. Such an analysis can be used to estimate the effect of exogenous injections such as increased export demand on output, employment and incomes with each of these being disaggregated according to the classification embodied in the social accounts of a particular SAM. An important advantage of SAM multiplier analysis compared to standard input-output analysis is that SAM multipliers cover the income distribution implications of different policies. SAM multipliers capture the total short-run effect of a change in an exogenous variable, on all the different accounts, and thus extend the multiplier analysis beyond the simple Leontief inverse in the same way that SAM extends the basic input - output (inter-industry) information. Even with its assumptions of linearity and cost-determined prices independent of demand the SAM multiplier analysis represents a powerful tool for applied general equilibrium analysis, because of the accounting requirement for economy-wide consistency.

However, it should be noted that the empirical results of

SAM multipliers and their interpretation depend crucially on the assumption of a constant matrix of SAM coefficients.This is a more substantial assumption than is common in input- output analysis, because the matrix of multiplier coefficients includes not only the standard input-output system (the inter-industry technology matrix) but also the coefficient matrix of factors and institutions accounts.It is important to stress here the link between appropriate classification and modelling. Provided that classified has been carried out according to the homogeneity principles, i.e so that the differences between the coefficients relating to different factors, institutions and activities are sufficiently great, then the economic model can be of analytical value, even though the absolute constancy of many individual coefficients is in doubt. This is because the scope of the feasible changes in coefficients over a period of time will be insufficient to erode the differences between coefficients which indicator the fundamental structure of the economy. The SAM multiplier analysis is useful for providing information about general directions and effects in the short- run and estimating broad orders of magnitude. In this sense, fixed coefficients linear models are a proven means of getting at orders of magnitude in relation to many economic problems.

In summary, although the multiplier analysis on a fixed coefficient matrix has several shortcomings from the economic modelling side, it can, nevertheless, be a good guide for an economy with respect to the direction and magnitude of structural interdependence. Examples of cases where this analysis has been applied are Iran (Pyatt 1975),Sri Lanka (Pyatt and Round 1979), Thailand (Fox, Pleskovic and Pyatt, 1983) and Egypt

(DRTPC, 1983). In all of these case studies, the multiplier analysis provided substantial insights into the impacts of development policy alternatives on the structure and linkages in the economy and on the income distribution across socio-economic groups. While modelling strategies based on SAMs exist which take into account price and quantity changes simultaneously and, therefore, give more flexible results, these strategies also require much more time, financial resources and data inputs. In this sense, there is a trade - off between simpler and quicker multiplier analysis and more sophisticated non-linear macroeconomic modelling. In the end the level of required detail and sophistication in a model depends crucially on the questions to be addressed for policy analysis.

We may now turn to an explanation of the SAM multiplier concept, beginning with the analysis of the model. The theoretical basis of the SAM multiplier analysis is basic neo-Keynesian aggregate demand analysis extended to a multi- sector approach. As is well-known from macroeconomic literature, the aggregate demand multiplier is the ratio that links the ultimate change in GNP to the initial change in spending. The major purpose of multiplier analysis is to determine the increase in total national income as a result of an increase in an exogenous variable, such as investment, government demand or exports. We can see how the multiplier works starting with a single one-sector model.

In the simplest possible case we have:

$$Y = cY + I \quad \text{------1]}$$

and the multiplier is equal to $dY/dI = 1/1-c$ or $1/s$,

where Y = national income

c = average propensity to consume

I = autonomous investment

s =average propensity to save

In this simple closed economy investment represents injections into the economy, and savings represent leakages out of the income stream (in this case only savings), implying that the higher the leakages are the smaller will be the multiplier and vice-versa. This model's basic assumptions are : 1. linear relationship between variables 2. no supply constraints and 3. fixed prices.

The same concept can be applied to an open economy and it can be extended to include foreign trade, taxes and transfers. In such an economy there will be more leakages (savings, taxes and imports) and more injections. The multiplier showing the total effect of injections on income can be determined the same way as above and would, in this case, be equal to

$$k = 1/1-c(1-t) + z \quad \text{--------2]}$$

where k = multiplier

c = marginal propensity to consume

t = tax rate

z =marginal propensity to import

The magnitude of the multiplier will again depend on the magnitude of the leakages.

In the simple model presented in equation 1.above there was only one good (sector) and only one homogeneous institution (households). Using the SAM data base the multiplier model can be broadened to include different institutions (several households, companies and government sectors) and different productive sectors (represented by the inter-industry matrix). Since the SAM framework gives the explicit relationship between institutions, productive sectors and markets by using matrix algebraic techniques it is possible to derive a set of multipliers for the endogenous accounts represents in the SAM. This set of multipliers, called the multiplier matrix, is in essence, a disaggregation of the basic Keynesian multiplier represented by equation 2. The disaggregated multipliers then reveal the differential impact of an exogenous injection on each institution, factor and activity. Such a multiplier model uses the same underlying assumptions as the simple Keynesian model above, but it gives a set of detailed multipliers that show the linkages between institutions, factors and activities. The SAM multipliers can thus be interpreted as Keynesian multipliers for a disaggregated (multi-sector) economy.

The SAM multiplier is based on the same algebraic formulation as the input- output multiplier analysis. In both as we have indicated above, the initial assumption is fixed coefficients for the multiplier matrix (the matrix of endogenous accounts). In order to derive such a model the basic SAM is partitioned into endogenous and exogenous accounts. Endogenous accounts in this model are factors, institutions (except government) and activities. The corresponding exogenous accounts are those for government current expenditures, consolidated

capital account and the rest of the world. Schematically, the division into endogenous and exogenous accounts is represented in the following table. If we divide each element in the columns of matrix N by the corresponding column totals we obtain a matrix of average endogenous expenditure propensities called the coefficient matrix A. If we denote the vector row sums of submatrix X by Xn the following expression holds :

$$Yn = AYn + Xn$$

and by substitution we obtain

$$Yn = (I-A)Xn = MaXn$$

where Ma denotes the accounting the accounting multiplier matrix which relates endogenous incomes Yn to injections Xn. It follows that changes in the vector of injections Xn will change the vector of endogenous incomes Yn. Given the Yn, we can compute the new matrix of endogenous transactions, N, by multiplying A by the new Yn. As in the case of the standard input-output model, we can, for example, compare the demand for factors before and after the change in exogenous demand (injection) and obtain the multiplier effect as the difference in factor incomes. We can distinguish between the direct multiplier effect, which refers to the change due to the increase in other factor incomes. The concept of SAM multipliers is thus analogous to input - output multipliers, except that it covers, in addition to inter-industry transactions, also income distribution effects.

A Brief Resume :

We have seen, so far, a brief introduction to the SAM concept with a special focus on the role of the SAM accounts in organizing statistical information (expenditures and revenues) of

public and private activities and public and private companies and their interrelations with the rest of the economy. We have seen that, in the first instance, the SAM framework helps to organize various sources of data in a consistent manner. For example, different sources of data (such as national accounts, population census, taxation data, household surveys, input-output tables and publications on public enterprises) can be organized into an economy - wide data framework. This is especially useful for the developing countries, where the scarcity of data requires the best use of available information and where such a framework can be the most helpful in bridging the gaps in the data, either by clearly stated and documented assumptions on the basis of secondary sources or by using available statistical techniques.

Another important advantage of the SAM framework is that it can also be used for macroeconomic modelling policy analysis and several types of macroeconomic models can be built on the basis of a SAM.

2.6 Applications And Uses Of A SAM

This section will go into some of the applications to which SAMs have been put. The features of the SAM discussed so far make it serviceable in the analysis of distributional and employment issues. In these applications it gives an integrated description of macroeconomic structure , although the extent of its information content clearly depends on the range and network of classifications that can be achieved which in turn will largely depend on the detail and quality of available data. Nevertheless,

the SAM is seen as a way of tracking past performance and giving factual answers to fundamental questions about the interrelationship between the distribution of income and the structure of production.

In a study of the Malaysian economy in 1970 Ramesh Chander et al constructed a SAM in which the distribution of income between different factors and socio-economic groups is identified. It represented a departure from the United Nations SNA guidelines in various ways not the least of which was the prominence given to the functional and institutional distributions of income which are integrally connected to individual living standards and other development policy objectives. The SNA basically proposes a commodity balance approach to national income accounting. In giving equal emphasis to income/outlay accounts as to the production accounts the study brought together data from two major primary sources: a household expenditure survey and a production survey. This led to an integrated picture, in matrix form, of the interrelationships between income distribution and production structure in the Malaysian economy.

In the SAM both the factor and household accounts were disaggregated according to race and the geographic distinction between Peninsular and East Malaysia with an urban/rural split within Peninsular Malaysia.The Peninsula labour force is further disaggregated by education level, while its households are then subdivided according to the employment status of main income earners. Arguments for and against these choices are presented.

To mention a few other aspects of the study, first the distinction drawn between East and Peninsular Malaysia is desirable not only because of the inherent interest of the

regions but also because of large differences in data availability and hence in estimation methods.Second, to complete the SAM it was necessary to estimate inter-household transfers being the institutional analogue of inter-industry commodity flow. An attempt was also made to impute the labor component of unincorporated business income. These were, then, the major problems that had to be overcome in the attempt to quantify the generation, distribution and redistribution of income within Malaysia in a SAM framework.

Three other SAMs were constructed by Graham Pyatt and Jeffrey Round for three national economies, Iran, Sri Lanka and Swaziland. The SAMs focussed particularly on the distribution of income through disaggregation of household sector income and outlay accounts consistent with more conventional disaggregation of production, factors, etc. The SAMs were conceived as an initial step towards understanding income distribution as an integral part of the development process and were developed in parallel with work on planning models. The motivation for the work done by Pyatt and Round was the need for an information system to advise on the issues of opportunities and income distribution which have challenged the conventional emphasis in macroeconomics on growth per se. This need has been clearly identified by the International Labour Office, World Employment Programme, and implies the view that economic growth is inadequate as a policy objective unless its content, in terms of the living standards of different groups within society is spelt out. Acceptance of this position implies that conventional data systems which derive from a preoccupation with aggregate growth or average living standards must also be judged inadequate.

IRAN

In the Iran study the model that was used tried to show how income distribution influenced consumer demand and hence the structure of production. Further, it also dealt with the link going from production structure to factor payments and hence income distribution. Hence, both directions of causality were thought to be crucial in the Iran context. The model and data system were therefore designed to capture them both.The resulting SAM for Iran is of a very simple design.

SRI LANKA

One of the innovations of the Sri Lanka SAM over the Iran SAM is the introduction of factor accounts in addition to the production and institution accounts shown in the Iran SAM. Their main purpose was to receive factor payments both from domestic production activities and from the rest of the world. These, in turn, were mapped into the household and other institution accounts, thereby recording the factor income component of the gross income receipts of institutions. Non- factor incomes, such as current transfers between institutions and transfers from the rest of the world, augment factor income to yield gross income of institutions. The distinction between factor and institution accounts served two important purposes. First, it facilitated a clear distinction between factor income and non - factor income that arises from the redistributive process within the economy. These redistributive forces were thought likely to be a centrepiece of policy and planning strategy, and therefore needed to be captured in this way.

Second, the classification of factors can be entirely divorced from institutional classifications. The latter can be determined by a range of socio-economic considerations; for households these may include location and socio- ethnic factors as well as income level; for other institutions 'ownership' or purpose might be appropriate .

The arrangement of accounts in the SAM for Sri Lanka was a conscious attempt to capture the circular flow of income - from income generated by activities to factors; from factors to the institutions that provide factor services; and from the expenditure of income by institutions to demand on activities, and hence income generation. Prominence was also given within the SAM to employment and income distribution set in the framework of the level and structure of activity.

SWAZILAND

The SAM for Swaziland had nine factor accounts and seventeen institution accounts. 44 commodities were consolidated into one account as were 25 production activities. The distinction of activity accounts from accounts for the commodities which they produce comprises one of the main differences between the Swaziland and Sri Lanka matrices.Before considering this aspect, however there are several classifications embodied within the factor and institution accounts that are interesting to note.

The nine factor accounts, referred to above, are novel in several respects. It should be noted that the organizational aspects of the supply of agricultural factor services within Swaziland are complex: part of the land is held by the Swazi nation and the remainder is still owned by individuals - often

non - Swazis - and is generally farmed according to modern agricultural technology. Within the Swazi Nation Land, Rural Development Area (RDA) schemes are currently being introduced and significantly break away from traditional methods. In order to avoid an arbitrary division of the returns to land and labour of the self- employed in the agricultural sector, a composite factor was defined for each of these three types of land : Swazi Nation (traditional), Swazi Nation (R.D.A) and Individual Tenure Farms (I.T.F). Labour receiving employee compensation was shown as a separate category as was self - employment income from non-agricultural activities. Finally, returns to other capital (i.e capital other than land) are distinguished as between Swazi and non- Swazi controlled, a distinction which is of considerable importance in the policy context.

In the institution accounts a distinction between two forms of traditional Swazi household is noteworthy : those outside and those within the Rural Development Areas. Each household receives the major part of its gross income from the factor income deriving from its traditional agricultural activity, although typically this is supplemented by employee compensation and self-incomes. The remaining institutions are non-household institutions.

Use Of The SAM For Public Sector Analysis

Boris Pleskovic and Gustav Trevino, in 1975, used the social accounting approach for empirical analysis of the public sector in the Mexican economy.The SAM framework was applied to Mexico

with a special focus on the disaggregations of data accounts for the public sector. Some of the critical issues that were examined were : 1. What are the linkages between public manufacturing industries, private industries and the rest of the economy?
2. What are the differences in the cost structure or technology between public and private industries?
3. What are the important differences in the institutional and economic structure between the public and private sectors in Mexico for 1975?
The study also dealt with the evaluation of policy implications of an expansion of a particular public or private activity either through exogenous investment, increased export demand or increased government consumption on other parts of the economy and to evaluate the basic structure and linkages in the economy. A special emphasis was given to comparative analysis between public and private sectors and to indirect implications of various government policies on labour incomes, capital incomes and indirect employment effects.

The SAM was compiled from the national accounts, input-output matrix, and household income and expenditure surveys. Secondary sources of data were used in addition to obtain separate information for the public sector statistics.

Major features of the public sector in the economy were described by comparing this sector with the private sector and with the main variables of the economy as a whole, using twelve basic macroeconomic indicators such as public and private shares in GDP, in exports, imports, wages and salaries, operating surplus, domestic intermediate inputs, investment, domestic savings, taxes, employment, etc.

The accounts of the aggregate SAM could be disaggregated to obtain sector activity specific or company specific data that would allow a more detailed assessment of the role of both public and private sectors in the economy. Accordingly, a set of activity- specific and company specific macroeconomic indicators were developed, and these were disaggregated into ten indicators for public and ten for private activities. The accounts that were disaggregated were production activities, public companies and commodities.

Production Activities

Production activities were disaggregated into eleven public and private sectors. All of them, except agriculture and electricity, take place in both the public and private sectors. These eleven activities were agriculture, mining, petroleum and petrochemicals, consumer goods, chemicals, construction and inputs, capital goods, transport and communications and other services.

Public Companies :

These were disaggregated into three : PEMEX, electric companies and other public companies. The role of companies accounts is to collect a porion of the operating surpluses of production activities; to pay dividends to households, the government and the rest of the world; and to serve.

Commodities :

There were three types of commodities in the SAM : domestic, imports and exports. Only domestic activities were disaggregated. The rest of the accounts were not disaggregated further because the primary focus of this study is on public and private enterprises and public and private activities.

Multiplier Analysis :

Multiplier analysis, which is a modelling technique relatively simple to execute and which gives good short-term policy results for Mexico, was applied to the SAM for Mexico. We have also discussed the conceptual aspects of the SAM multiplier with a short presentation of the analytical model. We may now look at some of the results of it.

In general, the multiplier analysis shows what the linkages between factors, households, public and private companies and public and private activities in the Mexican economy. The multiplier analysis for Mexico highlighted the importance of the private consumer goods sector, private services and private commerce for the Mexican economy. For the public sector, they showed the importance of public services, petroleum and public transportation for the output generated in the Mexican economy. The multiplier analysis also highlighted the importance of public sector activities for generation of labour incomes, which, in turn, affect household income and employment demand.

The highest labour income multiplier for the Mexican economy, in 1975, were for public services, public commerce, public transportation, public construction and public mining. On the

other hand, the smallest labour income multipliers can be found for public chemicals, public capital goods and petroleum. Policy implications of these are that, given the structure of the Mexican economy in 1975, an expansion of the above-identified sectors, with high labour income multipliers is most likely to be important for increased labour and household incomes and indirect employment generation.

The aggregate multiplier results show that, in value terms, private sector activities are more capital intensive than public activities. The highest capital income multipliers can be found for private commerce, followed by agriculture and private services, while these multipliers are also relatively high for public mining, public commerce and public consumer goods. Household income multipliers show that households gain the most from an expansion of public services and public commerce; and private construction, private mining, and private services. These multipliers are important from the policy standpoint because an increase in household incomes is directly related to the living standards of the population. Additional disaggregation of the household account would, therefore, prove especially useful for the evaluation of income distribution implications of an expansion (increased investment) of a particular public or private sector.

The Study By Hayden and Round :

To cite another case study involving the use of a SAM, Hayden and Round (1982) explored the macroeconomic effects of a proposed thermal power station in Swaziland. They used an open, static, Leontief input- output model where household income-expenditure behaviour is accounted for through the endogenization of the production, factor and household accounts in the SAM. A series of annual impacts throughout the construction and operating phases of the proposed coal mine and power station complex were fed into the system. The multiplier effects,therefore,not only embrace the familiar inter-industry multipliers, but also include further multipliers arising out of the payment of factor incomes to households and their consequential use of this income for further expenditure on commodities.

A particular technical novelty of this system is the use of variable trade parameters. The trade parameters are simply marginal propensities to import various commodities. If they are low then the multiplier effects within the economy are likely are to be high, and conversely. These parameters were arbitrarily set to values in order to raise possible alternative scenarios. Each scenario led to differential effects on the distribution of income and employment creation. The results of the analysis in Swaziland showed that the multiplier effects of such a project on rural households calculated as a percentage of the initial effects might well be proportionately greater than the corresponding effects on urban households, due to the nature of the linkages within the economy.

The Botswana Study:

Following the use of the Swaziland SAM in assisting the appraisal of a large project, three further analyses have been carried out in conjunction with the Botswana government, making extensive use of the Botswana SAM. Although, the general methodology employed in each of the three analyses is similar they differ in respect of the type of exogenous change analyzed, the behavioural assumptions used within the context of the SAM and also in the emphasis placed on various multiplier effects which emanate in different parts of the economy. The three analyses carried out are as follows :

1. Some analyses of the impact of increases in government wage and salary rates in January 1978: This exercise analyzed some of the probable effects on prices, production, the distribution of household income and the government current account surplus arising out of two alternative levels of wage and salary settlements for government employees in the forthcoming wage round.

2. Some analysis of the impact of a foot and mouth epidemic on the Botswana economy (July, 1978):

Such an epidemic commenced in Botswana in 1977. The only battoir had to close down for three months and, at the time of the analysis, it was estimated that it would not be able to return to full capacity operations for a further 22 months. Due to the country's heavy dependence on the export of beef the epidemic was thought likely to affect all sectors. Hayden and Round, in this analysis, attempted to qualify these likely effects.

3. The EEC beef price and the Botswana economy (June 1979) : This

exercise calculated some of the effects on the economy of various possible alternatives in EEC policy regarding the price paid for beef supplied in Botswana. Botswana was particularly concerned about the effects of a cut in the EEC beef price on poorer rural households.

The analysis used a partial equilibrium approach based on fixed coefficient assumptions.For this analysis the approach utilised a combination of the price and quantity Leontief models to determine changes in factor incomes and sectoral output levels together with a variety of assumptions about household expenditure behaviour to close the income-expenditure loop of the system.

Outline Of The General Methodology :

Three stages in the analysis can be identified. The first stage considered the price-raising effects of the wage-increase, the second estimated the household income effects, while the third stage attempted to quantify some of the effects on outputs of domestic production sectors arising from induced expenditures out of increased household incomes.

First, to start with the price-raising effects,the exogenous change, or impact on the economy is an increase in the wage and salary rates of government employees. Due to Botswana's minimum wage policy it is assumed that a similar rise in employee incomes will occur in the private sector.Unless the increased labour costs are wholly financed out of operating surplus (profits) it is very likely that there will be at least some increase in domestic commodity prices. Now because of the nature of inter-

industrial interdependence, the price-raising effect on any one production sector will stem from not only the factor cost increases (i.e wage costs) but also from increased costs of raw materials purchased for other domestic industries. The full extent of these rises in domestic prices can be ascertained from the price model of standard input-output analysis.

However, this assumes that all industries are able to pass on their own cost increases as price increases but certain industries are not in a position to do so, for instance those industries selling an export commodity the price of which is determined in the world market. In these cases the change in prices is constrained to zero, and operating surplus is assumed to decrease by the total increase in costs, taking into account both the direct and the indirect cost increases.

The second stage of the analysis was to estimate increases in household incomes. This was estimated in two parts, the first being the increase in factor incomes. These increases are mapped into households pro rata according to the household shares of each type of factor income in the original SAM. Thus, household incomes will increase by varying percentages according to their endowments of different types of labour. The second part of the estimation of household incomes was to gauge the change in transfer (i.e non - factor) income which must be added to factorial incomes. This involved focusing on the interinstitutional transfer matrix in the original SAM (and the part relating to households in particular), using the pattern of transfer income payments and working out the structure of household incomes that would preserve the pattern of income transfers as in the original SAM. This was achieved with the aid

of a Leontief-type model for inter-household transfers and household incomes, but, in the event, the resulting indirect effects were numerically quite small.

The final stage of the analysis brought together the first two stages, namely the price-raising effects and the household income effects, and attempted via a range of possible scenarios, to ascertain the ramifications of household behaviour. Initially, the result of the price-raising effects means that if households maintain their initial purchases of goods and services in real terms then the value of their expenditures would have to be revalued upwards. However, household income would also have risen. If household income increases by more than the money value of goods purchased then a number of alternatives have to be examined with regard to the possible use of the additional net disposable income. For instance, the extra income could be spent on all commodities (domestically produced and imported goods) or on selected commodities (excluding necessities like foodstuffs), or wholly on imported goods. There are just three possibilities. Each of these demand reactions trigger different supply responses in the economy and can be examined separately.

Finally, the real output effects, highlighted in the third stage of the analysis, set in motion a second round of factoral income generation, household income increases and so on. Again, although these second round effects were considered they were of very small orders of magnitude, and subsequent rounds were even smaller.

Once, overall equilibrium has been achieved for output levels (production accounts) and for factor and household incomes, given the exogenous changes brought about in this case

by increases in the wages and salaries of government employees, tentative estimates of changes of other main aggregates can be made. All of this amounts to estimating elements of a new SAM (i.e an ex- post SAM) using parameters derived from the structure of the base, ex ante SAM, and the new equilibrium account totals. In this way, estimates were obtained, for example, of the net change in the balance of payments and government revenues after the postulated multiplier effects had worked themselves out.

2.8 Conclusions

Out of this discussion of social accounting matrices has emerged a number of possible applications to which they can be put and the important functions that they perform : data organization, reconciliation and a descriptive analysis of the structure of the economy are all facilitated by the use of the SAM. An important point of departure of the SAM from conventional macroeconomic accounting systems is, as we have seen, largely in the fact that the latter emphasize the physical production structure of the economy, neglecting the significant aspect of distribution of income and expenditures. In the SAMs, on the contrary, this pretermission is well taken care of. Hence, the SAM can portray a profile of the income distribution of the economy.

The economy - wide framework of the SAM enables it to uncover several indicators about the public sector and facilitates a comparison of the two sectors, public as well as private, besides tracing out the linkages of the public sector

with the economy at large.

The SAM also lends itself to analysis through macroeconomic modelling in much the same way as input- output analysis. Accordingly, it can be used to estimate the effect of one- time increases in exogenous variables on endogenous variables in the accounting framework.

Finally, there was a review of several empirical works involving the use of the SAM. These were case studies of Iran, Sri Lanka, Malaysia, Swaziland and Botswana. Towards the end, was discussed an application of the SAM for Public Sector analysis in which linkages connecting the public sector, private sector and the rest of the economy were a critical issue.

CHAPTER THREE

MACROECONOMIC MODELLING

3.1 Introduction

The method of economic enquiry most popular today is that of building economic models.A model is any theoretical construction which attempts to analyze and explain a phenomenon. In economics there are various types of problems which call for proper explanation before a solution can be thought of. The attempts at clarification of the issues, the analysis of the relationships between different factors acting on the phenomenon are called economic models. If reality is to be explained, we have to simplify our analysis by making assumptions about the nature and behaviour of the relationships between the factors influencing the phenomenon. From this point of view, economic models are nothing but simplified pictures of reality and those models that treat the aggregate economic behaviour of all individuals are called macroeconomic models.

The task of building a macroeconomic model is both a science and an art. It is a science in that we wish to specify our model in such a way that we can conduct controlled hypothetical experiments i.e we specify a number of economic relationships describing aggregate behaviour in the economy. These relationships can be strung together to form a model that describes, in a general way, the workings of the economy. If the model is well designed, our experiments will tell us what outcomes are implicit in a particular form of the model. When

some change occurs that has an impact upon one of the variables, we can trace the effects through an adequate model.

The task of building a macroeconomic model also requires some art. The art is involved in selecting the ideal degree of abstraction to employ in building the model. It is a general rule that complex models give only a few specific answers.These answers may frequently depend upon the value of certain magnitudes that may be difficult to observe or measure. Simple models, in contrast, give a few general answers that are frequently unambiguous. To put the point more directly, the purpose of an economic model is to abstract only the essential elements necessary to predict the behaviour of the economic variables in which the model builders are interested. In constructing a model we are trying to predict the behaviour of economic variables that is necessarily implied by the given set of economic relationships that make up a model. The more simply this can be done the better. Keeping a model simple is an art that needs to be perfected.

A model must clearly lay down the various relationships between different variables in the form of mathematical equations. A variable is any measurable magnitude that varies and in whose change we are interested either because of its direct importance or because of its effect on other variables. Variables may be stock variables (like the number of cars) or flow variables like production, consumption per period of time, or ratios between stocks and flows such as prices and savings rates.

The variables that are taken to be determined by the model are called endogenous variables. If we specify two aggregate economic relationships, each depending on two economic

variables such as income and interest rates, then some value of income and some interest rate will make both the relationships hold true simultaneously. These values are determined by the model and are hence endogenous.

Exogenous variables are changes that act upon the model, but that are determined outside the model. Although the case of these variables lies outside of the model, their effect operates upon the endogenous variables within the model.

Parameters of a model define the relationships between the variables in the model. Suppose we say that the amount of that people spend depends on their incomes, then the way in which it depends is defined by a parameter. The parameter that describes the relationship between income and spending enables us to predict spending if we know income since we have postulated that spending depends on income. How spending depends on income is given by a parameter of our model.

To write down the structure of a model is to state the relationships between our variables concretely. These relationships are called functional relationships. The relationship may be direct as between price and quantity supplied or inverse as between price and quantity demanded.The relationship may between a dependent variable, written on the left-hand side of the equation and one or more variables written on the right - hand side.

Economic relationships spelling out the model are classified as under :

a) Behavioural Relations: These reflect the voluntary choices of economic subjects, i.e individuals and firms. Examples of these

are simple supply - demand relationships, price - quantity relationships,etc.

b] Institutional Restraints: These show the operation of laws or rules of behaviour. Examples of such restraints are required reserve -deposit ratio, tax collection as functions of income,etc.

c] Technical relationships: These reflect technical choices which are represented by production functions.

d] Identities or Definitions: These are merely accounting relationships, simple truisms. Eg - the identity between national expenditure, national income and national output.

If the relationships are put in a mathematical form we can solve the model to find out the equilibrium values of the variables involved. This is possible only if the model is complete. Mathematically, it means that there must be as many equations as there are unknowns.If the unknowns are more than the number of equations the model is "underdetermined". If the unknowns are less than the number of relationships (equations) the model is "overdetermined".

3.2 Evolution Of Econometric Models

Econometric models were first built and seriously applied in Holland, U.S.A and Canada. This kind of research has understandably led to similar efforts in U.K, Japan, Israel, Greece, India and other countries. The earliest work dates back to the fifties when professional macroeconomic modelling was at a nascent stage. The challenge of macroeconomic an underdeveloped

economy at that time can well be imagined. Problems thrown up by inadequate data and the lack of perspective regarding the applicability of such models in LDCs are evident in those early models. Although the position is far from satisfactory, much progress has been made since those early days.

Broadly speaking, models for India can be divided into three generations. The largest number of models belong to the earliest generation.These were obviously the most severely constrained by a variety of data problems on top of the usual hurdles and disadvantages associated with new exploration.

It is not surprising, therefore, that they had to be small, simple and often rather close to textbook macroeconomic theory.

Nevertheless, these models served well as explorations in an important branch of economic analysis. It would not be an exaggeration to say that they uncovered the weaknesses of the available data base and prompted further quantitative research at the sectoral level.

Even though models of the first generation were simple, they were by no means routine. Despite considerable odds, each model had a specific focus and innovated wherever it was dealing with problems common with other models. To be specific, the major focus in different models includes issues such as price behaviour (Marwah, 1972); investment behaviour and endogenous population growth the role of foodgrain outputin growth and price stability (Pandit, 1973), interaction between monetary and real variables in the monetized component of the economy (Bhattacharya, 1975), the structure of monetary and financial markets (Gupta,1973); external trade (Dutta, 1964) and growth in a dualistic economy (Agarwala,1971).

In the second generation we have models by Pani (1977), Ahluwallia (1979), Bhattacharya (1982), Pandit (1982) and Srivastava (1981).The most important feature that distinguishes these models from the earlier ones is their emphasis on policy analysis. Most other features of these models follow from this objective.They are more disaggregated and therefore much larger. Also, there is an explicit recognition of the mixed nature and some other institutional characteristics of India's economy.They also go one step ahead of their predecessors by allowing for lagged, more varied and somewhat more complex adjustment processes. It must be noted that, unlike their predecessors, authors mentioned here have had the advantage of a considerably improved data base, a large variety of rigorous empirical studies that have emerged since the sixties and an increased professional interest in econometric research.

The third generation of macroeconometric models has already begun with a few models that have been estimated in the last two years. These include models by Ghosh, Lahiri, Madhur and Roy (1983), Pani and Seshan (RBI,1983). In many ways these models are quite similar to those included in the second generation. They are large and disaggregated and seek to carry forward the analysis of policy issues initiated in the immediately preceding models. The distinguishing feature of these models is that they explicitly deal with the problems of macroeconomic adjustment and address themselves to issues that have not until recently been discussed in formal quantitative terms. They would increasingly be used for policy evaluation and forecasting. It would thus appear that macroeconometric modelling for India has come of age.

3.3 Models for Policy Analysis

Despite the early start that macromodelling has had for India, we have not gone as far as many other LDCs have in developing, maintaining and using such models for policy analysis and forecasting. The attitude of policymakers as well as of the academic profession at large has generally been one of skepticism and at best lukewarm. This is possibly a major reason why development in this area of research has been so slow.A few points need to be highlighted in this context.

First, a large segment of policy formulation and evaluation in India as in other LDCs is concerned with institutional and structural changes which are rather difficult to deal with in terms of econometric models. For the methodology adopted in econometrics does not permit the freedom in choosing either the values of parameters or the types of relationships required for such changes. Moreover, many of the policy instruments designed to achieve structural changes cannot be quantified nor viewed in isolation of a variety of socio-political considerations. Consequently, the use of formal modelling, of whatever kind, is considerably restricted.

Secondly, the policy has largely been with long run rather than with short run problems. There is an implicit belief that the latter are either less important or, in case they are important, they can adequately be dealt with by certain rules of thumb. The long run policy has predominantly taken the form of intertemporal and intersectoral allocation of investment and has been handled in the framework of input - output models. The

behavioural segment of the complete model has usually been taken care of by means of simple and isolated relationships.

Third, as mentioned earlier, models of the first generation, which were available until the early seventies, were largely exploratory and therefore somewhat prototype in nature. Clearly, they were not suitable nor intended to be used for policy analysis or forecasting. They also differed quite widely in their structure and in the values of crucial parameters they gave rise to. This state of affairs obviously could not earn many users or promoters for macroeconometric models. Surprisingly, there was no dialogue either among the model builders themselves or between them and in the profession. Such a dialogue would have led to a better understanding and to the emergence of more useful activity in this area of economic analysis much earlier than it has.

While an econometric model is no crystal ball it can, nonetheless, provide answers which are not only plausible but also much better than what the other available techniques can offer. What is more, such questions are not only important but also recurrent. They may relate to policy formulation, policy evaluation or merely to a description of the economy under study. For instance, a number of questions relating to the dynamics of price behaviour, consequences of the alternative patterns of public finance on saving and capital formation, choice of an appropriate commercial policy, and intersectoral linkages can be handled with the help of econometric models.

A number of short - run problems like the ones mentioned above have assumed a relatively greater significance during the seventies. Partly for this reason and partly because of the widespread use of econometric models in other countries, the

attitude towards these models has now changed in India. In recent years, various government departments, academic and research centres and some of the institutions involved directly with policy formulation have started taking a keen interest in this line of research activity. In this regard, mention may be made of the Ministry of Finance, Planning Commission, Reserve Bank of India, National Council of Applied Economic Research , Institute Of Economic Growth and Delhi School Of Economics which are contributing to macromodelling activity in different ways.3 Consequently, we can look forward to the emergence of models that capture the complexities of our economy with increased accuracy.

3.4 Some Difficulties With Macroeconomic Modelling

General equilibrium analysis, which is the cornerstone of macroeconometric models is full of difficulties in the context of an underdeveloped economy. We simply do not know enough about the adjustments occurring within any particular market or across markets in a situation of disequilibrium. While we often have fairly reliable accounts of the various segments of the economy, they are usually fragmentary and do not, on that account, yield plausible paradigms for the complete structure. The problem, therefore, is not one of controversies between alternative paradigms which abound even in the case of developed economies, but rather the absence of analytically well - defined and empirically testable hypotheses.

According to the conventional viewpoint underdeveloped economies are supply constrained so that the Keynesian kind of macrotheory is not relevant to such economies. In this context, a few points may be noted.

First, the recent literature in macroeconomics argues that the distinguishing feature of the Keynesian approach is its emphasis on quantity adjustments and situations of rationing that will emerge in certain markets because of sluggish price adjustments. The question, therefore, reduces to whether and how far price adjustments can be relied upon for clearing the markets. Thus, one should distinguish between the general Keynesian methodology, as such, and the specific policy prescriptions that the Keynesians have generally followed in the mature industrial economies during the fifties and the sixties.

Second, the belief that the deficiency of demand is not a problem in LDCs may be an exaggeration. In the case of India, it is now increasingly felt that problems very akin to the Keynesian idea of deficient demand may have prevented some sectors of the economy from achieving higher levels of output than they actually have during the seventies.(Shetty, 1978; Chakravarty,1979). This line of reasoning should not suggest that supply constraints do not exist. On the contrary, output in the predominant agricultural sector is, by and large, supply determined. Supply bottlenecks may appear from time to time outside agriculture too, due to a variety of factors characteristic of an underdeveloped economy. In such situations, one would expect a lower value of the multiplier for real output as part of the increased demand will manifest itself in price hikes. Thus, the policy package has to have an appropriate balance between measures intended for

demand management and for supply management. While a disaggregated model can handle heterogeneity of this kind across sectors, the task is far more difficult with regard to heterogeneity over time.

Modelling the Indian economy is difficult for two additional reasons. First, the size and diversity of the economy is such that not all its parts are fully integrated in a market sense. In some sense, one is perhaps dealing with not one well - integrated economy but a conglomerate of sub - economies. This gives rise to a certain measure of imprecision, among other problems, whatever may be the nature of the model and the extent of disaggregation. Second, India has a relatively large public sector so that the economy is "mixed". This leads to a number of analytical and empirical difficulties. While models must explicitly reflect this characteristic of the economy, considerable care is also required with regard to the data base as well as the specification of several standard relationships.

3.5 Substantive Issues for Macromodelling:

Macroeconometric models are intended to capture the observed regularities between important macro - variables. To be meaningful the relationship must throw new light on the important issues facing the economy currently as well as those that have dominated the recent past. It is, therefore, pertinent to identify such issues in the context of the development of the Indian economy over the last three and a half decades.

For obvious reasons, the most pervasive and dominant issue has been the rate, structure and sources of growth. Most other issues are relevant only insofar as they have a bearing on this one. Slight differences in the decadal rates of growth and the year - to - year fluctuations in the level of output notwithstanding, the long term rate of growth of real GDP has stuck to about 3.5 percent per annum over the period under review. Fluctuations in the annual growth rate has, by and large, been due to the weather - induced variations in the performance of agriculture. Rates of growth in the non - agricultural sectors have also fluctuated but less markedly.

The food problem came to be a source of anxiety for planners and administrators right from the beginning of the planning process and continued to be so till the late sixties. The sluggish pace of growth of output in agriculture and of foodgrains in particular was seen as a major bottleneck in the pace of development. For obvious reasons, food assumes a crucial role as the basic wage good in a developing economy. Besides the general inadequacy of the quantity of food, availability per head did not show a perceptible change. The problem was aggravated by the recurrent harvest failures. Large imports of food and a generous food from the U.S under PL - 480 agreements helped the country to pull through the hard times till the late sixties. The seventies have, however, witnessed a marked improvement in the foodgrains situation due to the Green Revolution. Imports of food have now substantially come down though not disappeared altogether.

Despite the sluggish growth of the agricultural sector, the fifties, covering the first two Five Year Plans, were by and

large placid. Industrial growth was impressive --- averaging about 7.5 percent per annum. Expectation of an acceleraton in the rate of growth of the economy during the sixties and thereafter seemed to be quite justified. Prospects of such an expectation being fulfilled were enhanced by the possibility of a better performance on the food front. But while the availability of foodgrains did show a marked improvement since the late sixties, the growth rate of the economy as a whole failed to accelerate in any significant way.

One disturbing development towards the late fifties was regarding the balance of payments and the consequent state of foreign exchange reserves. This problem, aggravated by the continuing need for imports during the sixties, stayed with us till the mid-seventies. Thus, the poor performance of the economy during the sixties and early seventies in the presence of the aforesaid wage goods bottlenecks and the foreign exchange constraint is natural. In the second half of the seventies, the food situation became, by and large, quite comfortable and foreign exchange reserves were at an all time high thanks to the remittances of Indian workers abroad. Surprising, however, is the continuation of the slow pace especially of industrial growth even during a period when both the constraints appeared to have eased.

Failure to achieve a sustained increase in the rate of growth of GDP even with better performance in agriculture and, in particular, on the food front has obviously been due to a marked deceleration in the rate of growth of industrial output. The annual rate of industrial growth fell by nearly a half from about 8 percent per annum during the period 1950-51 through 1964-65 to

about 4 percent during the subsequent 15 years. While a number of hypotheses have been examined in this context, two related factors deserve special mention. These are a)reduction in the rate of public sector investment and b) shrinkage of the home market due to the dominant problems. The regulatory activities of various kinds also witnessed a marked increase in the second half of the fifties.

A second turning point came during the mid-sixties with what appears as a de-emphasis of planned growth. This development is mainly indicated by a decline in the rate of public sector investment (Srinivasan and Narayana, 1977; Shetty, 1978). While the annual rate of increase in real gross government investment was about 12 per cent up to 1964-65, it declined to just a little over 6 percent for the subsequent 15 years.

The exogenous shocks that the economy has suffered over the three decades have considerably disturbed its working in many ways. These shocks include the three military episodes (1962, 1965, 1971), political aberrations (1967-69, 1975-77), major crop failures (1957, 1965, 1966, 1973 and 1979) and the oil shock (1973 and 1979).

To sum up, an econometric model for India should attempt to highlight the following inter-related issues.

a] Overall and sectoral growth performance and the role of well identified supply and demand factors in determining this growth performance.

b] Interdependence of sectors for growth and price stability.

c] Trade, balance of payments and short run as well run as well as long run problems arising therefrom.

d] Growth- inflation trade-off and the fine tuning of monetary and fiscal policies including administered pricing and subsidies.
e] The saving-investment process and its relationship with factors such as inflation.
f] The place of the public sector and of government's regulatory policies in influencing growth and stability.
g] Importance of the food sector as supplier of the prime wage good in the economy.

3.6 Gaps To Be Filled In Existing Models

Two and a half decades ago, Klein (1965) asked the question: "what kind of macroeconometric model for developing economies"? This question continues to engage economists. Indian models of the second generation discussed earlier, have already made a beginning with some of the suggestions made by Klein. The process has been carried further in models of the third generation. Despite this progress, the gap between the desired model and the existing models remains large. This is so in a big measure because of the steadily increasing demands on econometric models. The less developed economies have grown more complex and have also been facing new challenges and problems-- domestic and international--- over the last two decades. Thus, an econometric model can make the grade only if it is capable of handling new issues and questions as they arise and reflects the new complexities that characterize the functioning of these economies.

Some of the directions in which econometric modelling has to push harder are fairly clear. Important among these are the

following: First, greater attention in these models needs to be paid to trade and balance of payments than has been done so far. An enlarged external sector must attempt not only to explain trade flows in some detail but also to systematically account for the current and capital transactions with the rest of the world. This is necessary to understand the extent to which the domestic economy is open to external factors. To avoid an endogenous explanation of trade and related phenomena on the plea that the Indian economy is relatively closed is no longer proper.

Second, future models must give recognition to the phenomenon of financial deepening that has taken place over the last two decades. The role of financial institutions should, therefore, be widened to show how these institutions influence at least the short run movements in the level of economic activity. The practice followed so far of limiting the models to only a few narrowly specified monetary variables seems to be quite inadequate. Third, the role of the public sector and the mixed character of the economy needs to be enlarged and more sharply focussed. The existing models have generally confined themselves to public investment, government consumption expenditure and taxation. Two additional factors that must be brought in are :

a] the interaction of the government and the public sector with financial institutions and b] explicit quantity rationing and administered pricing policies of the government. The latter should help to separate "flex-price" and fix-price markets in the Hicksian sense.

Fourth, a distinction between organized and unorganized segments of the economy is of considerable importance in India. Any realistic model must capture this distinction and show how it

has a bearing on output, employment, investment and pricing. However, it must be noted that finding even moderately reliable data in this regard is enormously difficult.

Last, but most important, there remains the crucial issue of giving due recognition to the problem of deficient demand without assuming away the supply bottlenecks that are likely to arise frequently in a less developed economy. The reason why we have, until recently, chosen to switch entirely in one or the other direction is not hard to find. It is no mean task to strike the correct balance between supply and demand, price adjustments and quantity adjustments and between stabilization problems of the short run and the growth problems of the long run. However, these are not the problems that plague merely the econometric models for LDCs but also the econometric models generally. These are problems that confront contemporary macroeconomics. No wonder that the last few years have witnessed the best in the profession grappling precisely with these problems. To name only a few, Hicks (1974), Malinvaud (1977 and 1980), Klein (1978 and 1983), Okun (1980), Tobin (1980) and Kornai (1982) have addressed themselves to the basic issues - empirical and analytical- without getting unduly embogged in a maze of technicalities. For modelling LDCs we may not find an entirely satisfactory solution for quite a while but a beginning has to be made in the search for the solution. There is little doubt that such a search will not succeed unless it draws on both theoretical as well as empirical tools available to us.

CHAPTER FOUR

ANALYSIS OF MACRO MODEL

4.1 Introduction

The objective of this chapter is to examine, on the basis of a simple macro model,the behaviour of the functional income distribution in India in response to various government policies.It is intended to shed light on the trend of the shares of agricultural income, wage income and profit income under diferent macroeconomic policy regimes.

In every case a 10 percent increase is given to a policy variable such as investment or exports or imports, under various wage-indexation and mark-up specifications.A similar exercise is carried out with respect to balanced budget policies such as a simultaneous increase in indirect taxes and transfers as well as in profit taxes and transfers.The macroeconomic effects therefrom are observed on the relative shares of agricultural, wage and profit incomes.

The analysis is conducted within an adapted version of Lance Taylor's model (1983) of short-run adjustments in the Indian economy. The data base for the model is structured in the form of a social accounting matrix (SAM) and it is around the SAM that the model is built.The model equations are parameterized in such a way as to satisfy the SAM.

Accordingly,this chapter begins with a discussion of the link between the SAM and macro models.It then presents the CGE model for the Indian economy together with a social accounting

matrix for India (1980-81).Policy experiments are then made and their results and interpretations discussed.

4.2 Social Accounting Matrices and Macroeconomic Modelling

Chapter Two provided a discussion of the SAM,its origin, background and purpose.It was noted that the SAM had a wide range of applications and some of the studies using it as a tool were also surveyed. In Chapter Three the discussion turned to macro-modelling,tracing the evolution of econometric models,their role in policy analysis in India and their applications.

Inasmuch as the present chapter contains a CGE macro model calibrated according to a social accounting matrix for India (1980-81) it might be in order to briefly review the link between macroeconomic modelling and social accounting matrices that was referred to in Chapter 1.CGE models rely on the social accounts framework and the social accounting matrix (SAM) to capture national income and product as well as input-output information.The fundamental law in economics that every income has a corresponding outlay or expenditure defines the relationship between CGE models and SAMs.The SAM approach that follows from it is therefore an analytically convenient way of tackling problems in economics that starts out by setting the problem within the framework of a social accounting matrix.

4.3 A Social Accounting Matrix For India, 1980-81

The SAM for the year 1980-81 is shown below. The entries are in rupees crores at current prices. Rows 1-5 are the productive sectors of the economy. The sectors are:

1. Food agriculture, consisting of cereals, pulses and vegetables.
2. Other agriculture (all non-food agriculture, animal husbandry, forestry, fishing, and other allied activities).
3. Industry (manufacturing) comprising organized and unorganized manufacturing activities and construction.
4. Infrastructure and energy consisting of railway transportation,mining and quarrying, electricity, gas and water
5. Services (the rest of the productive sectors).

The gross domestic output of food agriculture (32802) satisfies intermediate input demands (columns 1-5), private consumption demand (column 6), government demand (column 7), demand for investment and stock changes (columns 8a and 8b and exports 9a). Column 9b) represents competitive imports entering with a negative sign. Rows 2 through 5 consisting of other productive sectors are similarly accounted. In row 3 the export subsidy (328 in column 10) is added to get the industrial exports at market prices.

Referring to the total output (deliveries) of 32802 of sector 1 (row 1), one would find the same total appear in the bottom of column 1 showing total cost of production (claims) of food agriculture. The value added corresponding to this sector (column 1 row 6c)) is assumed to accrue to agricultural income. The fertilizer subsidy given to farmers in this sector,309,

appears with a negative sign in row 11, column 1: Column 2 corresponding to the cost of other agriculture is similarly accounted.

Columns 3, 4 and 5 representing claims of the other producing sectors are again similar except the value added accruing to households' private income (row 6a) and non-agricultural non-wage income (row 6b).

Row 6 represents generation of private income which is the sum of (1) income from agricultural sectors 1 and 2; (2)wage and non-wage incomes from sectors 3, 4 and 5; (3)government wage payments, government transfers to households and payment of debt interest (column 7) and (4) remittances from abroad (2400 corresponding to column 9a). It is assumed that remittances, government wages and transfers accrue to wage income whereas interest accrues to non-wage income.The total of row 6 is 120470 which appears at the bottom of column 6 showing uses of household income.

Private income is used (column 6) for buying commodities and services (row 1 through 5), paying direct taxes (row 13) and for savings (row8). The food subsidy enters as a negative expenditure (row 11).

Columns 8a and 8b are gross capital formation of the economy by types of assets. The figure 1211 is capital good imports which is non-competitive investment import. The total of columns 8a) and 8b) is 27417. The same figure appears in total for row 8 showing accrual of gross savings.

Row 7 shows generation of government income.Income accrues from a)surpluses of public undertakings (columns 3, 4 and 5) b) indirect taxes (column 11) and direct taxes (column 12). The

total income 21180 is used (column 7) to purchase commodities and services (rows 1 through 5), paying wages and salaries, transferring income and paying interest (9021in row 6 is the total of these three payments) and subsidy payments 328 in row 10 and 1327 in row 11 and savings (row 8).

In row 9 imports are treated in two categories, Non-competing imports by producing sectors (1 through 5), and investment import (column 8a) and competitive imports (3782, column 9b) adding to total import bill of 11300. Row 8 shows the accrual of gross savings and is composed of private savings (column 7) and foreign savings (column 9a). The total 27417 is exactly equal to the gross capital formation which is the sum of columns 8a) and 8b).

Row and column 10 show the subsidy of 328 paid as export subsidies in the form of reimbursing taxes and duties. Row 11 accounts for production and consumption subsidies. The total subsidy paid (1327 in column 7) to different sectors (1 through 5) and households enters as a positive expenditure item in government uses (column 7). Rows 12 and 13 along with columns 11 and 12 show accounting of indirect and direct taxes respectively.

Table 4.3.1: A Social Accounting Matrix For India, 1980-81

	Food agr	Other agr	Industry (mfrg)	Infra/ energy	Services	Use of Private income	Use of govt revenue	Gross Fixed investment	Stock changes	Export	Competitive import	Export Subsidy	Indirect taxes	Direct taxes	Total (gross out)
1. Food agr	1895	463	907	-	509	29383	173	-	-528	-	-	-	-	-	32802
2. Other agr	1117	3396	8164	-	382	11190	60	-	-	2272	-35	-	-	-	26546
3. Industry (manufacturing)	2700	2167	27054	1201	8944	23479	2499	23186	3428	4473	-3747	328	-	-	95712
4. Infrast and energy	107	86	3203	1994	1423	2574	354	-	120	355	-	-	-	-	
5. Services	1450	1183	18665	850	9988	28811	4438	-	-	-	-	-	-	-	65385
6a.Non-agr wage income	-	-	10736	3053	19455	-	7633	-	-	2400	-	-	-	-	43277
6b.Non-agr non wage income	-	-	9146	2035	19848	-	1388	-	-	-	-	-	-	-	32417
6c.Agr income	25530	19246	-	-	-	-	-	-	-	-	-	-	-	-	44776
6 (6a+6b+6c) Private income	25530	19246	19882	5088	39303	-	9021	-	-	2400	-	-	-	-	120470
7. Government income (revenue)	-	-	1738	141	566	-	-	-	-	-	-	-	15794	2941	21180
8. Gross savings	-	-	-	-	-	22637	2980	-	-	1800	-	-	-	-	27417
9. Imports	312	276	5719	-	-	-	-	1211	-	-	3782	-	-	-	11300
10.export subsidy	-	-	-	-	-	-	328	-	-	-	-	-	-	-	328
11.Prod/cons subsidy	-309	-271	-202	-	-	-545	1327	-	-	-	-	-	-	-	0
12.Indirect taxes	-	-	10582	942	4270	-	-	-	-	-	-	-	-	-	15794
13.Direct taxes	-	-	-	-	-	2941	-	-	-	-	-	-	-	-	2961
14.Total (gross output)	32802	26546	95712	10216	65385	120470	21100	24397	3020	11300	0	328	15794	2941	-

Note:All values are in Rs crores at current prices

Source: Sarkar, H and Rao,S.V, A Social Accounting Matrix of India for 1980-81,Margin, July 1981, Vol 13 No4,p.30-31.

4.4 A Macro Model for India

Having presented the SAM, the next step is to set out equations for the model built around it. A key assumption of this model is that the two agriculture sectors are price-clearing. i.e equilibrium between demand and supply is attained through price-adjustments, while in the rest of the economy output levels adjust to meet demand.

The following two tables show the model's equations and the variables and parameters respectively. The equations are divided into blocks, to be described successively.

Block 1 contains input - output balances,in which demand (to the left) is set equal to supply for the four sectors.(In the original model by Lance Taylor five sectors were included, the first two being food-agriculture and non-food agriculture. However, in the light of data inadequacy and in the interest of convenience, these two sectors have been consolidated into a single agricultural sector in the adapted version of the model). The entries correspond to the first five rows of the SAM, the convention being that base-period prices for sectoral outputs are all set to one.

Block 2 has equations defining agricultural and wage incomes Y_a and Y_w. Value-added in the two agricultural sectors is calculated to give Y_a.

Wages in the non-agricultural sectors and for government employees are assumed to be partially indexed to the cost of living within the model's solution period of one year. Equations 7-10 give the details of the response of wages to changes in the consumer price index, CPI. Wage income Y_w in equation 10 comes

from production activities, government employment and transfer payments from the government (TR).

Block 3 sets out price equations for the non-agricultural sectors with prices determined by a mark-up over variable costs. In manufacturing and services the mark-up rates τ_2 and τ_4 are taken from Lance Taylor's model. Prices are given in the simultaneous system 12-14, in which terms for sales taxes at rate t_i for sector i as well as subsidies granted to manufacturing production (sub_2) also figure.

Block 4 gives expressions for variable costs per unit of output.Income from profits then follows in Block 5, as the sum of mark-ups over variable costs less government revenues GR_i from public enterprise production. Depreciation on capital stock is subtracted from mark-up incomes and government interest payments are added to the final value of Y_z.

Block 6 contains equations for levels of consumer spending from agricultural and non- agricultural incomes (D_a and D_n respectively). From agricultural income Y_a is subtracted agricultural saving at rate s_a to give D_a in equation 15. Saving parameters along with income taxes at rate t_z on profit income Y_z are also included in the determination of D_n in equation 16.

Block 7 specifies sectoral consumption levels according to the widely used complete set of demand equations known as the linear expenditure system, or LES. There are two sets of parameters for the LES - base levels of commodity consumption (O^a_i and O^i_n, i=1,....,4), which are assumed to be independent of income and prices, and marginal propensities to consume (m^a_i and m^n_i, i=1,....,4) from incomes above the levels D^o_a and D^o_n required to pay for the base-level purchases. These parameters

summarise both price and income responsiveness of consumption. The demand equations appear in equations 19-26.With the addition of the subsidy quantities sectoral consumption levels are obtained in (28).

Equation 29,which specifies that demand less the fixed supply for the agricultural commodity must equal zero serves to close the system. The algorithm contained the following steps:

1.The sectoral output levels X_1 , X_2 ,....,X_4 and a trial price P_1 for the agricultural sector were guessed.

2.The non-agricultural mark-up rates and prices from the equations in Block 3, variable costs per unit of output in Block 4 and profit income in Block 5 were calculated.

3.Using the trial price and outputs, the wages, wage and agricultural incomes in Block 2, variable costs per unit of output in Block 4 and profit income in Block 6 were calculated.

4.Sectoral levels of demand from Block 6 and 7 were calculated.

5. The totals of sectoral demand were added, using the expressions to the left of the equality signs in Equations 1-4. If any sectoral demand level differed from its corresponding trial value by more than a prespecified tolerance, the trial value was set equal to the demand level and step 2 was repeated. This was continued until demand levels were very close to trial output values for all sectors.

6. If output level X_1 was not very close to the prespecified agricultural supply level X the price P_1 was modified and step 1 was repeated. This continued until excess demands for the agricultural products were effectively zero.

At the end of this solution procedure, all sectors were in demand- supply equilibrium and as a result saving equalled

investment. This derived relationship appears as equation 34 of the model. To get to this expression for macro balance, government and trade accounts are defined in equations 30-33. These equations summarize the fiscal and balance of payments effects of all the tax and subsidy programmes described above.

For the government,Equation 31 gives its current revenue GREV made up of direct tax receipts, indirect taxes and revenues from enterprise. The five terms in Equation 32 for current expenditure GEXP are, respectively, wage payments to functionaries, transfers, depreciation on government capital stock, government interest payments and the subsidy to manufacturing industry.

Equation 33, Block 10, defines the trade deficit in rupee terms.

Next appears the saving-investment balance in Block 11. Saving to the left of the equals sign comes from households, the government current account and the trade deficit. Investment on the right includes capital formation and stock changes.

TABLE 4.4.1 EQUATIONS FOR THE MACRO MODEL FOR INDIA

1.Demand-Supply Balances By Sector

$$\sum_{j=1}^{4} a_{1j} X_j + C_1 + S_1 + G_1 + E_1 - M_1 = X_1 \qquad 1.$$

$$\sum_{j=2}^{4} a_{2j} X_j + C_2 + E_2 + I_2 + S_2 + G_2 + E_2 - M_2 = X_2 \qquad 2.$$

$$\sum_{j=1}^{4} a_{3j} X_j + C_3 + S_3 + G_3 + E_3 - M_3 = X_3 \qquad 3.$$

$$\sum_{j=1}^{4} a_{4j} X_j + C_4 + S_4 + G_4 + E_4 - M_4 = X_4 \qquad 4.$$

2. Generation of Nonprofit Income Flows

$$Y_a = P_1 X_1 - \sum_{i=3}^{4} a_{i1} P_i X_1 \qquad 5.$$

$$CPI = \sum_{i=1}^{4} \alpha_i P_i \qquad 6.$$

$$w_i = w_i^{\circ} + kw_i (CPI - CPI^{\circ}), \quad i=2,3,4 \text{ and } g \qquad 7.$$

$$Y_w = \sum_{i=2}^{4} w_i b_i X_i + w_g L_g + R + TR \qquad 8.$$

3. Price Equations for Nonagricultural Sectors

$$P_2 = \frac{(1 + t_2)(1 + \tau_2)(a_{12} P_1 + a_{32} P_3 + a_{42} P_4 + w_2 b_2)}{1 - (1 + t_2)(1 + \tau_2) a_{22} (1 - sub_2)} \qquad 9.$$

$$P_3 = \frac{(1 + \tau_3)(1 + t_3)(\sum a_{13} P_1 + a_{43} P_4 + w_3 b_3)}{1 - (1 + \tau_3)(1 + t_3) a_{33}} \qquad 10.$$

$$P_4 = \frac{(1 + \tau_4)(1 + t_4)(\sum a_{14} P_4 + w_4 b_4)}{1 - (1 + \tau_4)(1 + t_4) a_{44}} \qquad 11.$$

4. Equations For Variable Costs In Nonagricultural Sectors

$$B_2 = \sum_{i=1}^{4} a_{12} P_1 + w_2 b_2 - sub_2 P_2 a_{22} \qquad 12.$$

$$B_j = \sum_{i=1}^{4} a_{ij} P_i + w_j b_j \quad , \quad j = 4 \text{ and } 5 \qquad 13.$$

5. Generation of Income from Nonagricultural Markups

$$Y_z = \sum_{i=2}^{4} (\tau_i B_i X_i - GR_i) - (1-\phi)DEP + GINT \qquad 14.$$

6. Consumption from Agricultural and Nonagricultural Incomes

$$D_a = (1 - s_a) Y_a \qquad 15.$$

$$D_n = (1 - s_w) Y_w + (1 - s_z)(1 - t_z) Y_z \qquad 16.$$

7. Sectoral Consumption Functions

$$D^o_a = \sum_{i=1}^{4} O^a_i P_i \qquad 17.$$

$$D^o_n = \sum_{i=1}^{4} O^n_i P_i \qquad 18.$$

$$C^a_1 = O^a_1 + (m^a_1 / P_1)(D_a - D^o_a) \qquad 19.$$

$$C^a_i = O^a_i + (m^a_i / P_i)(D^a - D^o_a), \quad i=2,\ldots,4 \qquad 20\text{-}22$$

$$C^n_1 = O^n_1 + (m^n_1 / P_1)(D_n - D^o_n) \qquad 23.$$

$$C^n_i = O^n_i + (m^n_i / P_i)(D_n - D^o_n), \quad i=2,\ldots,4 \qquad 24\text{-}26$$

$$C_1 = C^a_1 + C^n_1 \qquad 27.$$

$$C_i = C^a_i + C^n_i, \quad i= 2,\ldots.4. \qquad 28.$$

8. Model Closure

$$X_1 - X = 0 \qquad 29.$$

9. Governmental Balances

$$T^{ind} = \sum_{i=2}^{4} t_i (1 + \tau_i) B_i X_i \qquad 30.$$

$$GREV = t_z Y_z + T^{ind} + \sum_{i=2}^{4} GR_i \qquad 31.$$

$$GEXP = \sum_{i=1}^{4} P_i G_i + w_g L_g + TR + \phi DEP + GINT + sub_2 a_{2\,2} X_2 \qquad 32.$$

10. Trade Deficit

$$DEF = \sum_{i=1}^{4} M_i - \sum_{i=1}^{4} X_i - R \qquad 33.$$

11. Saving - Investment Balance

$$s_a Y_a + s_w Y_w + s_z (1 - t_z) Y_z + (GREV - GEXP) + DEF = P_2 I_2 + \sum_{i=1}^{4} P_i S_i \qquad 34.$$

TABLE 4.4.2 SYMBOLS FOR THE MODEL

1. Sectors

1.Agriculture
2.Manufacturing Industries
3.Infrastructure
4.Services

2.Endogenous Variables

X_i	sectoral output levels, i= 1,.....,4
P_i	sectoral price levels, i= 1,.....,4
C_i	sectoral levels of consumption demand, i=1,.....,4
C_i^a	sectoral consumption levels from agricultural income, i=1,.....,4
C_i^n	sectoral consumption levels from nonagricultural income, i= 1,.....,4
W_i	sectoral wage rates, i=2,....,4
W_g	government wage rate
B_i	variable costs per unit of output, i=2,3,4
τ_2	markup rate in sector 2
τ_4	markup rate in sector 4
Y_a	income in agriculture
Y_w	wage income
Y_z	markup income
D_a	consumption spending from agricultural income
D_n	consumption spending from nonagricultural income
D°_a	floor level consumption from agricultiural income
D°_n	floor level consumption from nonagricultural income
S_i	change in private stocks of sector 1 products
CPI	consumer price index for urban consumption
T^{ind}	indirect taxes
GREV	government revenue
GEXP	government spending
DEF	trade deficit

3. Exogeneous Variables (in Rs10,000 crores)

G_i	government demand for commodities, G_1=.0233 G_2=.2499 G_3=.0354 G_4=.4438
S_i	change in sectoral stocks, i= 1,....,4 S_1=-.0528 S_2=.3428 S_3=.012 S_4=0
E_i	sectoral exports, i=1,.....,4 E_1=.2272 E_2=.4473 E_3=.0355 E_4=0
M_i	competitive imports, i=1,....,4 M_1=.0035 M_2=.5719 M_3=0 M_4=0
I_2	investment demand for sector 2 products, 2.31
L_g	government employment .000127
TR	transfer payments, 0
sub_2	subsidy rate for manufacturing industries, .002110
τ_3	markup rate in sector 3, .306565
t_i	indirect tax rates, i=2, 3, 4. t_2=.1243 t_3=.101574 t_4=.069868
DEP	total depreciation, .9282
ϕ	share of depreciation for government capital .4049

GR_i government profits from enterprises, i=2,3,4. GR_2=.1738, GR_3=.0141, GR_4=.0566

t_z tax rate on profit income, .109

GINT .1388

X fixed output levels

R remittances, .24

4. Parameters

a_{ij} sectoral input - output coefficients, i,j= 1,....,4. a_{11}=.1158 a_{12}=.0948 a_{13}=0 a_{14}=.0136 a_{21}=.0820 a_{22}=.2827 a_{23}=.1176 a_{24}=.1368 a_{31}=.0033 a_{32}=.0335 a_{33}=.1952 a_{34}=.0218 a_{41}=.0444 a_{42}=.1950 a_{43}=.0832 a_{44}=.1528

$m^a{}_i$ marginal propensity to consume from agricultural income. $m^a{}_1$=.264172 $m^a{}_2$=.35388 $m^a{}_3$=.01743 $m^a{}_4$=.1882

$m^n{}_i$ marginal propensity to consume from nonagricultural income. $m^n{}_1$=.109415 $m^n{}_2$=.33929 $m^n{}_3$=.02103 $m^n{}_4$=.39532

$O^a{}_i$ floor-level consumption from agricultural income (in Rs10,000 crores) i= 1,....,4. $O^a{}_1$=1.54991 $O^a{}_2$=.14801 $O^a{}_3$=.07376 $O^a{}_4$=.19846

$O^n{}_i$ floor-level consumption from non-agricultural income, i=1,....,4. (in Rs10,000crores) $O^n{}_1$=.95493 $O^n{}_2$=.5521 $O^n{}_3$=.09038 O_n4=1.20443

b_i sectoral labour-output ratios, i=2,3,4. b_2=.000017 b_3=.000043 b_4=.000061

s_a savings ratio for agricultural income 0.12

s_w savings ratio for wage income 0.1482

s_z savings ratio for profit income .2223

α_i weights in the consumer price index, i= 1,....,4. α_1=.4167 α_2=.4987 α_3=.0423 α_4=.0423

k_{wi} wage-indexation coefficient, i= 2,3,4,g. 0, .1,.3

4. Initial Values

$w^\circ{}_i$ beginning- of- period wage level, i=2,3,4 and g.(in Rs) $w^\circ{}_2$=6489.44 $w^\circ{}_3$=6925.25 $w^\circ{}_4$=4826.88

CPI° beginning-of-period consumer price index 1.00

Parameterization: Setting up a model based on a SAM provides scope for addressing questions of income distribution and intersectoral interaction that are ignored in one-or-two sector specifications. As consistency and accounting identities are principal considerations in this exercise, it is clear that model equations must be parameterized in such a way as to satisfy the SAM. Observations on the main parameters listed in the table follow:

1.The input-output coefficients a^i_j are obtained directly by division of intersectoral flows by gross outputs of the sectors.

2. Savings rates were computed to satisfy the overall saving-investment balance of the SAM.

3.Labour-output ratios b_i follow from the wage bill and the wage rate by sector.

4.The initial values of the variables such as sectoral outputs were read directly from the SAM.

5.Parameters such as (a)marginal propensities to consume from agricultural and non-agricultural income were taken directly from the original model by Lance Taylor as were (b)mark-up rates (c)indirect tax rates (d)floor-level consumption from non-agricultural income.

4.5 NUMERICAL RESULTS OF POLICY EXPERIMENTS AND INTERPRETATIONS:

The results of the various policy experiments are presented below.The initial situation represents the position of equilibrium where aggregate supply equals aggregate demand and prices of the various sectors are set at unity. Changes are made in investment under various wage-indexation and mark-up regimens and their effects on the initial equilibrium are explained and interpreted.

Table 4.5.1 Initial Equilibrium:

Initial Output	Computed Output	Initial Prices	Computed Prices
X_1=5.9348	X_1=5.9348	P_1=1	P_1=1
X_2=9.5712	X_2=9.5712		P_2=1
X_3=1.0216	X_3=1.0216		P_3=1
X_4=6.5385	X_4=6.5385		P_4=1

Incomes	Income shares	Labour-Output ratios
Y_a=4.4784	Y_a/Y=38.96%	b2=.000017
Y_w=4.3277	Y_w/Y=37.65%	b_3=.000043
Y_z=2.6893	Y_z/Y=23.39%	b_4=.000061

Experiment 1: Investment in manufacturing increased by 10%, k=0

RESULTS

Table 4.5.2

Shares of Incomes	Growth Rates Of Income	Prices	Output
Y_a/Y=45%	Y_a/Y_a=39%	P_1/P^1=35%	X_1/X_1=0.00
Y_w/Y=32%	Y_w/Y_w= 2%	P_2/P_2=11%	X_2/X_2=5.00%
Y_z/Y=22%	Y_z/Y_z=13%	P_3/P_3=14%	X_3/X_3=2.00%

The share of agricultural income increases because of the much higher growth of the agricultural income (39%) as compared with

the growth of wage incomes and profit incomes (2% and 13% respectively).This differential may be traced to the higher rate of increase of prices in the agricultural sector (35%) than in the manufacturing, infrastructure and services sector (11%, 14% and 9% respectively).This happens because the increase in investment raises the demand -determined output level in manufacturing and also creates a further demand for inputs from the agricultural sector. As a result of this added demand pressure, the agricultural sector, whose output is fixed in the short run, witnesses an increase its price.However, prices in the other sectors do not rise as much because they are characterized by quantity adjustments to increases in demand.

The share of wage income declines mainly due to the relatively slower rise in wage income by 2%. This happens because the growth in employment is a meagre 1.7% and wages remain constant, there being an absence of wage indexation.

The share of profits undergoes a negligible change as mark-ups remain fixed and non-agricultural outputs increase very sluggishly by about 3%.

Experiment 2: Investment increased by 10%, k=.3

RESULTS

Table 4.5.3

Shares of Incomes	Rates of Increase of Incomes	Prices	Outputs
$Y_a/Y=47.50\%$	$Y_a/Y_a=108\%$	$P_1/P_1=100\%$	$X_1/X_1=.2\%$
$Y_w/Y=29.80\%$	$Y_w/Y_w=35\%$	$P_2/P_2=51\%$	$X_2/X_2=.07\%$
$Y_z/Y=22.50\%$	$Y_z/Y_z=65\%$	$P_3/P_3=61\%$	$X_3/X_3=2.9\%$
		$P_4/P_4=51\%$	$X_4/X_4=1.7\%$

It is observed that the share of agricultural income increases

even more when wages are indexed than otherwise. This is because, as a result of wage indexation, wage incomes are much higher than in Experiment 1.Consequently,demand,from wage earners,for agricultural products, is much higher now than before leading to an even higher rate of increase in agricultural prices and agricultural income. As a result the share of agricultural income is higher in this case than in the previous one.

Wage share is observed to decline, the reason being that wages are only partially indexed to prices.Hence, in the ratio Y_w/Y, since prices rise faster than wages, wage income rises less than total income, causing a decline in the share of wage income.

Profits increase in absolute terms. This is because of an increase in manufacturing output due to the rise in investment.However, the share of profit income in total income drops from the initial equilibrium since in the ratio Y_z/Y total income rises faster than profit income owing to the higher rate of increase of agricultural as compared to non-agricultural prices.

Experiment 3: Investment increased by 10%, k=0, τ increased by 5%.

RESULTS

Table 4.5.4

Shares of Incomes	Rates of Change of Incomes	Prices	Outputs
$Y_a/Y=42\%$	$Y_a/Y_a=22\%$	$P_1/P_1=20\%$	$X_1/X_1=0.0$
$Y_w/Y=34\%$	$Y_w/Y_w=1\%$	$P_2/P_2=10\%$	$X_2/X_2=4.0\%$
$Y_z/Y=24\%$	$Y_z/Y_z=18\%$	$P_3/P_3=11\%$	$X_3/X_3=0.1\%$
		$P_4/P_4=10\%$	$X_4/X_4=0.6\%$

The share of agricultural income increases for the same reasons as in Experiment 1. But in the present case its share is

restricted to around 42% since profit income share has also increased.

Wage income share shows a decrease since profit and agricultural income shares have increased.However,the wage income share does not decline as far as in Experiment 1 since the difference between the rate of growth of agricultural income and that of wage income is much less by 21% in the present situation than in Experiment 1.

Experiment 4 : Investment increased by 10%, k=.3 and τ increased by 5%.

RESULTS

Table 4.5.5

Shares of Incomes	Rates of Increase of Incomes	Prices	Outputs
$Y_a/Y=44.92\%$	$Y_a/Y_a=85.3\%$	$P_1/P_1=80\%$	$X_1/X_1=0.00$
$Y_w/Y=30.76\%$	$Y_w/Y_w=31.33\%$	$P_2/P_2=48\%$	$X_2/X_2=5.40\%$
$Y_z/Y=24.32\%$	$Y_z/Y_z=67.11\%$	$P_3/P_3=55\%$	$X_3/X_3=2.20\%$
		$P_4/P_4=49\%$	$X_4/X_4=0.97\%$

In this situation the share of agricultural income is even higher than in Experiment 3 owing to a higher wage indexation of .3 and the higher wage income resulting therefrom which gives a further boost to consumption of agricultural products as examined in Experiment 2.

The analysis regarding wage income share is similar to that provided in Experiment 2.

Profit income share, as expected, is roughly the same as in Experiment 2 since the mark-ups are unchanged.

The policy experiments, so far, reveal that expansionary

policies of increased investment benefit the agricultural sector at the expense of wage earners in the non-agricultural sector.Agricultural income share is observed to increase in all four cases of investment increases examined above.

Profit income share is observed to either increase or fall very marginally. No substantial drop in the share of profit income takes place. Even under increased mark-up rates the share of profit income registers only a very small increment.

Wage income shares are observed to fall appreciably in all the cases taken up so far. Interestingly, wage indexation, far from enhancing the share of wage earners actually reduces it still further, conferring an added benefit to the agricultural sector in terms of an increased share in total income.

Experiment 5: Imports of manufacturing products increased by 10%, k=0

This policy experiment assumes importance in the light of the government's current policy of import liberalisation to encourage the growth of the manufacturing sector by allowing the import of capital goods.

RESULTS

Table 4.5.6

Shares of Incomes	Rates of Change of Incomes	Prices	Outputs
Y_a/Y=37.83%	Y_a/Y_a=-5.60%	P_1/P_1=-.05%	X_1/X_1=0.00
Y_w/Y=38.58%	Y_w/Y_w=-0.35%	P_2/P_2=-.02%	X_2/X_2=-.8%
Y_z/Y=23.59%	Y_z/Y_z=-1.90%	P_3/P_3=-.02%	X_3/X_3=-.36%
		P_4/P_4=-.02%	X_4/X_4=-.22%

In this situation aggregate demand falls owing to a 10% rise in

imports. By comparison with the initial equilibrium, agricultural income share falls with a drop in agricultural income which takes place due to a fall in agricultural prices. The latter is caused by a fall in demand owing to the contractionary effect of increased imports on manufacturing and other sectoral outputs and incomes.

With the fall in agricultural prices the other sectoral prices also fall due to the resulting decline in the cost of agricultural inputs. The fall in the prices of the other sectors leads to a decline in profit income although its share remains roughly stable.

Wage income falls due to a drop in employment as a result of the contraction of non-agricultural output arising from the increase in imports. The drop in employment, however, can at best be marginal as according to the above results, the fall in outputs and prices is very small. Hence, the wage income share is seen to rise.

Experiment 6: Imports of manufacturing products increased by 10%, k=.3

RESULTS

Table 4.5.7

Shares of Incomes	Rates of Change of Incomes	Prices	Outputs
$Y_a/Y=38.34\%$	$Y_a/Y_a=-3.36\%$	$P_1/P_1=-.03\%$	$X_1/X_1=0.00$
$Y_w/Y=38.19\%$	$Y_w/Y_w=-0.39\%$	$P_2/P_2=-.01\%$	$X_2/X_2=-.78\%$
$Y_z/Y=23.47\%$	$Y_z/Y_z=-3.96\%$	$P_3/P_3=-.02\%$	$X_3/X_3=-.40\%$
		$P_4/P_4=-.01\%$	$X_4/X_4=-.32\%$

In this situation agricultural income share falls but not by as much as in Experiment 5. This is because agricultural prices have

fallen less (.03%) than in Experiment 5 (.05%).This could be explained by the fact that the increase in imports causes output in the manufacturing sector to contract thereby setting off a price fall.Since wages are indexed, however, the demand for agricultural products would not cause as much of a fall in demand for agricultural products as in the previous case.The role played by the marginal propensity to consume could also be relevant in this context, as a higher marginal propensity to consume would increase demand.Hence, the sluggish price effect.

Wage income share rises but not as much as in Experiment 5 since the increased wage indexation hurts wage earners more while prices fall. Profit share is roughly stable.

Experiment 7: Imports increased by 10%, k=0, mark-ups increased by 5%

RESULTS

Table 4.5.8

Shares of Incomes	Incomes	Rates of Change of Prices	Outputs
Y_a/Y=35.77%	Y_a/Y_a=-11.80%	P_1/P_1=-10.00%	X_1/X_1= 0.00
Y_w/Y=38.82%	Y_w/Y_w=- 0.97%	P_2/P_2= 0.29%	X_2/X_2=-1.76%
Y_z/Y=25.41%	Y_z/Y_z= 4.14%	P_3/P_3= -1.26%	X_3/X_3=-1.10%
		P_4/P_4= 1.38%	X_4/X_4=-1.10%

In this situation agricultural income share has fallen even below that in Experiment 5. This is because agricultural prices have fallen by 10% compared to almost no change in Experiment 5 as a result of the increase in non-agricultural prices caused by an increase in the mark-up rates. The rise in non-agricultural prices,in turn, reduces consumption of agricultural products as is reflected by Equation 23 in the model.Profit income share increases owing to the rise in mark-ups. Wage income share, as a

residual, increases owing to the fall in agricultural income share.

The foregoing policy experiments with increases in imports may now be summed up as having the following effects on income distribution: Agricultural income share falls owing to the depression of agricultural prices, wage income share is observed to rise in all the three cases and profit income remains roughly stable, except in the case where an increase in imports is accompanied by an increase in mark-ups.In this event,an increase in profit share is witnessed.

Experiment 8: Exports increased by 10%, k=0

This policy experiment is of topical relevance when viewed in the context of the government's current policies aimed at reducing the current account deficit in the balance-of-payments.The renewed thrust on overseas market expansion makes it interesting to examine probable macroeconomic effects of an exogenous increase in exports.

RESULTS

Table 4.5.9

Shares of Incomes	Rates of Increase of Incomes	Prices	Outputs
$Y_a/Y=40.02\%$	$Y_a/Y_a=5.60\%$	$P_1/P_1=5\%$	$X_1/X_1=0.00$
$Y_w/Y=36.76\%$	$Y_w/Y_w=0.38\%$	$P_2/P_2=2\%$	$X_2/X_2=0.91\%$
$Y_z/Y=23.22\%$	$Y_z/Y_z=2.04\%$	$P_3/P_3=2\%$	$X_3/X_3=0.42\%$
		$P_4/P_4=1\%$	$X_4/X_4=0.26\%$

In this situation a 10% increase in exports under non-wage indexation results in an increase in the share of agricultural income and a fall in the share of wage income. Profit income

share holds roughly stable.

Agricultural income share increases owing to a rise by 5% in the price of the agricultural sector. This happens on account of the expansion of output and incomes in the non-agricultural sector which exerts a demand pull on the agricultural sector from the non-manufacturing sector.

The wage income share is observed to fall as agricultural income and profit income rise relatively more than wage income.

Experiment 9: Exports increased by 10%, k=.3

RESULTS

Table 4.5.10

Shares of Incomes	Rates of Increase of Incomes	Prices	Outputs
$Y_a/Y=41.88\%$	$Y_a/Y_a=37.30\%$	$P_1/P_1=35\%$	$X_1/X_1=0.00$
$Y_w/Y=34.77\%$	$Y_w/Y_w=17.92\%$	$P_2/P_2=21\%$	$X_2/X_2=1.85\%$
$Y_z/Y=23.35\%$	$Y_z/Y_z=23.35\%$	$P_3/P_3=24\%$	$X_3/X_3=0.94\%$
		$P_4/P_4=35\%$	$X_4/X_4=0.73\%$

Here it is seen that the share of agricultural income increases a bit more when wages are indexed than otherwise. This is because of the extra consumption demand for agricultural products from the wage earners,leading to higher agricultural prices and therefore higher agricultural income growth.

Wage income share declines as the rate of increase of wage income is much lower than that of agricultural income.

Profit income share remains more or less stable.

Experiment 10: Exports increased by 10%, k=0, τ increased by 5%

RESULTS

Table 4.5.11

Shares of Incomes	Rates of Change Of Incomes	Prices	Outputs
Y_a/Y=37.03%	Y_a/Y=-5.60%	P_1/P_1=-5%	X_1/X_1= 0
Y_w/Y=37.76%	Y_w/Y=-0.36%	P_2/P_2= 2%	X_2/X_2=-.22%
Y_z/Y=25.21%	Y_z/Y=25.21%	P_3/P_3= 1%	X_3/X_3=-.37%
		P_4/P_4= 3%	X_4/X_4=-.62%

In this situation agricultural income share falls, wage income share remains roughly stable and profit income share increases. Agricultural income share falls because of the fall in wage income which reduces consumer demand for agricultural products, thereby depressing agricultural prices.

Wage income share remains stable but wage income falls owing to the drop in employment.

Profit income share rises because of the increase in non-agricultural prices following the rise in mark-up rates by 5%.

An important observation here, is that the non-agricultural sectors' outputs have fallen, though marginally.This seems surprising considering that export increases are generally expected to have expansionary effects.The explanation for it, however,may be that the non-agricultural price increases,through their depressing effect on sectoral consumption levels in Equation 24-26, are responsible for the contraction of non-agricultural outputs.

Experiment 11: Exports are increased by 10%, k=.3, τ increased by 5%.

RESULTS

Table 4.5.12

Shares of incomes	Rates of Increase of Incomes	Prices	Outputs
Y_a/Y=39.56%	Y_a/Y_a=25.42%	P_1/P_1=25%	X_1/X_1=0.00
Y_w/Y=35.32%	Y_w/Y_w=15.9%	P_2/P_2=21%	X_2/X_2=0.67%
Y_z/Y=25.12%	Y_z/Y_z=32.61%	P_3/P_3=23%	X_3/X_3=0.00
		P_4/P_4=24%	X_4/X_4=-.32%

In this case profit income share increases due to the mark-up increase of 5% and the rise in non-agricultural prices. Wage income share falls as wage income increases only by 16% as compared to profit income (33%) and agricultural income (25%). Agricultural income share is almost stable.

Experiment 12: Balanced Budget Policies: Indirect tax rate on manufactured goods increased by 15%, Transfers increased by Rs 6400 crores.

RESULTS

Table 4.5.13

Shares of incomes	Rates of Change of Incomes	Prices	Outputs
Y_a/Y= 47.23%	Y_a/Y_a=66.9%	P_1/P_1=60%	X_1/X_1=0
Y_w/Y=32.02%	Y_w/Y_w=17.1%	P_2/P_2=20%	X_2/X_2=3.79%
Y_z/Y=20.75%	Y_z/Y_z=22.13%	P_3/P_3=26%	X_3/X_3=2.60%
		P_4/P_4=19%	X_4/X_4=2.51%

It is seen that all the three kinds of incomes, agricultural, wage and profit increase as a result of the increase in sectoral outputs and prices. In terms of income shares, however, agricultural income share expands and the shares of profit and wage incomes decline. This is because agricultural prices rise by 60% whereas non-agricultural prices and outputs rise by about 22% and 3% respectively.

outputs and prices. In terms of income shares, however, agricultural income share expands and the shares of profit and wage incomes decline. This is because agricultural prices rise by 60% whereas non-agricultural prices and outputs rise by about 22% and 3% respectively.

Experiment 13: Indirect Tax rate on Services increased by 15%,Transfers increased by Rs 6405 crores.

RESULTS

Table 4.5.14

Shares of Incomes	Rates of Change of Incomes	Prices	Outputs
$Y_a/Y=47.23\%$	$Y_a/Y_a=66.9\%$	$P_1/P_1=60\%$	$X_1/X_1=0$
$Y_w/Y=35.32\%$	$Y_w/Y_w=15.9\%$	$P_2/P_2=21\%$	$X_2/X_2=0.67\%$
$Y_z/Y=20.76\%$	$Y_z/Y_z=22.15\%$	$P_3/P_3=25\%$	$X_3/X_3=2.60\%$
		$P_4/P_4=18\%$	$X_4/X_4=2.51\%$

The effects of this policy change are more or less similar to the ones in the previous case. Again, agricultural, wage and profit incomes have increased. Agricultural income share has expanded, while those of profit and wage incomes have fallen owing to the much higher rise in agricultural sector prices (60%) as compared to non-agricultural prices and outputs (21% and 3% respectively).

Experiment 14: Profit tax rate increased by 15%,Transfers increased by Rs 3382 crores.

RESULTS

Table 4.5.15

Shares of Incomes	Incomes	Rates of change of Prices	Outputs
Y_a/Y=44.52%	Y_a/Y= 39.16%	P_1/P_1=35%	X_1/X_1= 0
Y_w/Y=33.83%	Y_w/Y=9.41%	P_2/P_2=11%	X_2/X_2=2.56%
Y_z/Y=21.65%	Y_z/Y=12.66%	P_3/P_3=14%	X_3/X_3=1.77%
		P_4/P_4= 9%	X_4/X_4=1.88%

It is seen that the share of agricultural income has risen though not by as much as in the previous two cases. This is because the tax on profit income reduces consumption spending from non-agricultural income as a result of which demand for agricultural products declines.However, the previous two cases deal with indirect taxes which do not affect consumption demand according to the model.

Summary

It would now be in order to summarize the major findings from the analysis that has been carried out.The policy experiments that were made involved administering a ten percent increase in the policy variable (investment, imports and exports successively) and the effects were observed on the relative shares of agricultural wage and profit incomes. The results may be summarized as follows:

1. Under expansionary policies of investment and export increases,profit income shares are invariably observed to either rise or remain stable. Any fall in the share of profit income is at best marginal.

The share of wage incomes generally declines. Interestingly,

wage indexation, far from enhancing the share of wage earners actually cuts it down in favour of the share of agricultural income.

Agricultural income is invariably observed to increase at the expense of wage incomes.

2. Under expansionary policies of a balanced budget involving simultaneous increases in the profit tax rate (or the indirect tax rate) and transfers, agricultural income is always observed to rise. Profit and wage income shares decline.

3. Under deflationary conditions of import increases agricultural income share falls owing to the depression of agricultural prices. Wage income share rises and profit income share generally remains stable.

CHAPTER FIVE

CONCLUSION

This study has been made in the context of social accounting matrices and macroeconomic models and has had as its objectives the examination of the effects of various government policies on the functional income distribution in India.Attention has been focussed on the shares of agricultural income, wage income and profit income under various macroeconomic policy regimes. The analysis has been conducted within an adapted version of Lance Taylor's model of short-run adjustments in the Indian economy based on a social accounting matrix.

It has been pointed out that there is a close relationship between CGE models and SAMs based on the economic law that every income has a corresponding outlay.This relationship makes it analytically convenient to build the model around the SAM by parameterizing it in such a way as to satisfy the SAM.

CGE models have been used for policy analysis in both developed and developing countries. In the former they have focussed on microeconomic issues whereas in the latter they have been applied to a wider range of issues such as growth, resource allocation, migration, etc.

Much has been said about social accounting matrices and their role in organising statistical information of public and private activities and their interrelationships with the rest of the economy. The SAM helps to organise various sources of data consistently. Different sources of data such as national accounts, population census, taxation data, household surveys, input-output tables, etc can be organised into a unified economy-

wide framework. The SAM, therefore, is especially useful for developing countries where the data are scant and demand the best use of available information.

To illustrate this,a profile of case studies of Iran,Sri Lanka, Malaysia, Swaziland and Botswana was presented and an application of the SAM for public sector analysis was examined, tracing out the linkages connecting the public sector, private sector and the rest of the economy.

The use of the SAM for macroeconomic modelling has prompted a discussion of macromodelling in ganeral and its applications to the Indian context in particular.It was in Holland, U.S.A and Canada that macro models were first built and applied and this spawned similar efforts in other countries like India, U.K, Japan, Israel and Greece. Macro models for India can be divided into three generations, the first covering all those models that emerged between 1960 and 1976, the second generation spanning the years 1977-1982 and the third commencing in 1983. Models of the second generation differ from those of the first in their emphasis on policy analysis, their higher degree of disaggregation and their explicit recognition of the mixed nature and other institutional characteristics of the Indian economy. Models of the third generation are fairly similar to those of the second generation the main difference being that the more recent ones explicitly deal with the problems of macroeconomic adjustment and address issues that were not quantitatively discussed in the past.

A few points regarding policy formulation in India are noteworthy. First, much of the policy formulation and evaluation in India is concerned with institutional and structural changes

which are difficult to model. This has restricted the use of formal modelling.Second, policies have generally been concerned with long-run rather than with short-run problems.This may be attributable to an implicit belief that the latter are less important. The long-run policy has predominantly taken the form of intertemporal and intersectoral allocation of investment and has been handled in the framework of input-output models. A number of short-run problems have, however, recently assumed significance. These relate to the dynamics of price behaviour, effects of different patterns of public finance on saving and capital formation, choice of appropriate commercial policies and intersectoral linkages.

The most dominant issue in Indian macromodelling has been the rate, structure and sources of growth. The food problem has also figured substantially, given the crucial role played by food as the basic wage good in a developing economy like India. The balance-of-payments and the consequent state of foreign exchange reserves are majors issues of current relevance.

The present paper has used a simple macroeconomic model of the Indian economy to analyse the impact on income distribution of various government policies. The emphasis on income distribution has meant that some other issues such as the effects on trade and balance of payments have been pushed to the background; actually,exports and imports are exogenous in the model. The choice of focus has even influenced the level of disaggregation;an analysis of the effects of tariff changes or excise duty changes, for instance, would have required a much greater level of disaggregation. For the intended uses of the model it was thought adequate to tailor it closely after Lance

Taylor's (1983) India model.

The policy experiments that were made involved administering a ten percent increase in the policy variable (investment, imports and exports succcessively) and the effects were observed on the relative shares of agricultural, wage and profit incomes. The results may be summarized as follows:

1. Under expansionary policies of investment and export increases,profit income shares are invariably observed to either rise or remain stable. Any fall in the share of profit income is at best marginal.

The share of wage incomes generally declines. Interestingly, wage indexation, far from enhancing the share of wage earners actually cuts it down in favour of the share of agricultural income.

1.Agricultural income is invariably observed to increase at the expense of wage incomes.

2.Under expansionary policies of a balanced budget involving simultaneous increases in the profit tax rate (or the indirect tax rate) and transfers, agricultural income is always observed to rise. Profit and wage income shares decline.

3. Under deflationary conditions of import increases agricultural income share falls owing to the depression of agricultural prices. Wage income share rises and profit income share generally remains stable.

It is especially noteworthy that agriculture gets the lion's share of any expansion in the total output. This is because, according to the formulation of the model,agricultural prices are very sensitive to increases in demand as agricultural output is fixed in the short-run.Prices in other sectors do not rise as

much as agricultural prices do as these sectors are characterised by quantity adjustments.

Undoubtedly, the results obtained reflect the choices made in the specification of the model. Yet, these choices may not have been very unrealistic. Agricultural prices do seem to have more flexibility than the prices of industrial goods, which are quite often subject to mark-up schemes. Still, further work adopting alternative specifications within the same broad,overall model structure, will clearly highlight the limitations and strengths of the model.

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