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INDIAN MACRO ECONOMETRIC MODELS ON MONETARY – FISCAL NEXUS : A SURVEY

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PREFACE

Centre for Multi-Disciplinary Development Research is a social research institute in a moffusil area of Karnataka. It is one of the national level research institutes, sponsored by the Indian Council of Social Science Research (ICSSR), New Delhi. The Centre aims at undertaking analytical studies of conceptual and policy significance on the socio-economic and cultural issues using multi-disciplinary perspectives and micro level information.

As a part of its publication programme the Centre has initiated a CMDR Monograph series and also publications based upon the research studies completed at the Centre.

We are happy to present the 15th in the CMDR monograph series. This monograph entitled "Indian Macro Econometric Models on Monetary - Fiscal Nexus : A Survey" authored by one of our collegues Mrs. Geetharani. This monograph presents a review of literature on the macro econometric models focusing on the monetary fiscal linkages policy nor the fiscal policy would be effective in macro economic management. A judicious combination of the 2 policy measures has been the subject matter of a number of Econometric excersises. The Centre expressed its appreciation and thanks to Mrs. P. Geetharani for a technical review of the Literature on the subject. The Centre looks forward to the comments and observations on its monographs from the readers.

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P. GEETHA RANI

INTRODUCTION :

The twin major goals of Indian economy are price stability and gross domestic product (GDP) growth rate. However, if price stability is not maintained, the achieved growth rate gets depreciated. In the Indian context, inflation rate is contributed more by monetary expansion. Thus, controlling inflation indicates regulating money supply. The theory of money supply suggests that money stock can be controlled through high powered money provided the money supply function is more stable than the money demand function.

The alternative available in the theoretical literature is controlling the money demand through rate of interest if money demand function is more stable than the money supply function. The theory also suggests that both can not be operationalised simultaneously. In the Indian situation, since interest rates are administered and the empirical literature too suggests that money supply function is more stable than the money demand function, controlling money stock is aimed at monitoring high powered money.

High powered money itself varies as it accommodates government deficit. Hence, the stock of money varies endogenously as reserve money receives impulses through deficit from the fiscal sector. The issue of monetary-fiscal nexus is one of the most important channels through which the major instruments or policy variables - budget and the Reserve Bank of India (RBI) policy variables - influence the economy in both short and long run.

Hence, the inter-linkages between monetary and fiscal sectors gain the focus of the present survey. A substantial part of government deficit is financed by the RBI credit to government which is the main source of reserve money which, in turn, forms the basis for money supply process. In the same way, the interaction of the monetary sector with the real sector is reflected in the demand for money function and price formation. Like wise, the external sector has a link with the monetary sector in the determination of net foreign assets of RBI. Thus, the monetary-fiscal nexus can not be viewed in isolation as it sends and receives impulses from other sectors as well.

BRIEF OUTLINE OF EVOLUTION OF INDIAN MACRO ECONO-METRIC MODELS :

The branch of macro econometric modeling in the Indian economic literature has been initiated in the fifties and it has

been gaining importance in the subsequent periods. The earliest macro model was presented by Narasimham (1956) under the guidance of professor Tinbergen. Since then, model building activity has been intensified. Several macro econometric models have emerged which are larger in size, diverse, complex and technically sophisticated.

The models in the 1970s constitute the first phase which are pioneering contribution towards economy wide models with general objectives. These economy wide models shed light on price behaviour and stability, endogenous population growth, structure of financial markets and growth in dualistic economy. The second phase models incorporate specific objectives in the economy wide models following the convention of earlier models to some extent, laying emphasis on policy analysis. They are more disaggregated and involve more complex adjustment process by introducing lagged values.

The third phase models are increasingly sharpened their focus leading to a greater variety and diversification. Having attained analytical sophistication during the first and second phases, the modeling effort in the third phase attempt for more purposeful and task oriented models with specific objectives, dealing with problems of specific macro economic adjustments. They are of policy evaluation, forecasting and exploratory in nature.

The latest trend in macro econometric models is reflected in the growing size, scale and complexity that they tackle. The growing knowledge of econometric approaches, significant improvement in computer techniques and strength of data base, sectoral statistics, team work have persuaded building and use of macro econometric models in abundance with complexity.

In an earlier attempt, Desai (1974) has surveyed Indian macro econometric models till 1960s. In general, these models surveyed follow Tinbergen-Klein tradition. He views that the treatment of monetary modeling in 1970s are either non-existent or elementary in nature. Money supply in these models is treated as exogenous and not clearly specified. Government sector in these models are under specified.

Later, Krishnamurty and Pandit (1984) have taken stock of the macro econometric models till 1980s. They classify the Indian macro models into three generations. They view that the earliest generation models are small, simple and prototype model closer to text book theory. These models are fraught with difficulties in the data and with new exploration. Most of these models are research effort as doctoral dissertations and are of pioneering efforts at exploring an uncharted and immensely complex economy.

The second generation models mainly emphasis on policy analysis. They are disaggregated and larger in size. These

models identify mixed and institutional characteristics of the Indian economy. They go one step further by allowing for lagged, more varied and somewhat more complex adjustment process. Third generation models are more or less similar to the second generation models. The distinct feature of these models are that they deal with problems of macro economic adjustments and they attempt to explore issues that have not been examined until recently.

A recent survey was undertaken by Jadhav (1990) in which the models are surveyed under the classification of explanatory, structural, exploratory and policy oriented and forecasting types of models.

The present survey confines to simultaneous, multi-sector models which focus specifically on the nexus between monetary and fiscal variables after 1980s. It attempts to examine is there any consensus on the factors that influence monetary-fiscal nexus, movement of major macro economic variables and their interactions, and their robust and sensitive nature towards specification of economic relations.

The present survey concentrates on the following models in the Indian context :

Sarma (1982) is a simple explanatory model. It has five equations. It covers the period from 1961-62 through 1979-80. The Aghevli-Khan (1978) model for developing countries is replicated by Sarma in the Indian context. This model questions the monetary proposition of uni-directional causality from money supply to price level. He examines the relationship between government deficit, inflation and money supply.

Mathur, Nayak and Roy (MNR) (1982) is a short term macro economic forecasting and policy formulation model. It covers the period from 1951-52 through 1979-80. Their main focus is on the budgetary impact of certain key macro economic variables - inflation, money and credit.

Krishnamurty(1984) is a structural and explanatory model. It is an elaborate economy wide model with 77 equations covering the period from 1961 through 1980. It covers the agricultural, industrial, tertiary, fiscal, monetary and price sectors.

Pandit (1984) also follows the tradition of structural and explanatory type of models. It is also an economy wide model with 58 equations covering the period from 1950-51 to 1977-78. This model describes agricultural sector, saving-investment equilibrium, external, fiscal, monetary and price sectors.

Pani (1984) also belongs to structural, explanatory and economy wide model. It has 79 equations. It covers the period from 1969-70 through 1981-82. This model attempts to analyse the factors determining output, demand, government fiscal operations, money supply and prices in the Indian economy.

Chakrabarty-(CB) (1987) is a policy oriented model. This model has 32 equations. It covers the period from 1962-63 to 1983-84. It aims to incorporate the institutional features of the economy. This model highlights the linkages among various sectors namely real (domestic and foreign), fiscal and monetary sector. It also deals with the determination of the general price level.

The focus of the models in the 1990s is specific on a particular issue. Jadhav and Singh (JS) (1990) and Rangarajan and Arif (RA) (1990) belong to this tradition. JS (1990) is an exploratory type. This model focuses on single relationship and attempts to explore all the possible inter-linkages among the macro variables - inflation, budget deficit and money supply. It tries to incorporate the missing links in Sarma (1982). It covers the period from1970-71 through 1987-88 with 14 equations.

RA (1990) captures the impact of money supply on output and price level with 20 equations covering the period from 1961-62 to 1984-85. The special feature of this model is it attempts to link credit and output by introducing real money or credit as an additional variable in the production function.

As the links between monetary and fiscal variables inherit movements in price, output and foreign trade, the discussion is organised as follows :

The common features of models are presented in section 1. Section 2 deals with the monetary sector considering demand for money and supply of money specifications in various models. The fiscal sector is disaggreagted into government expenditure, government revenue and budget deficit and analysed in section 3. Movements in prices captured in these models follow either monetarist or structuralist approach and is dealt in section 4. Section 5 presents how the real sector specifications are carried out in these models. Section 6 examines the external sector and the concluding remarks are presented in the last section.

The latest version of the models are only considered in the study.The variables specified in the models are attempted to give a common notation for the same variable (as it is found varying notations in different studies) are presented in appendix 1. The review considers only the specification of various equations and not the estimated empirical results. The equations explained in the models are given in appendix 2.

1. Common Features

The models under consideration belong to different categories such as descriptive [Sarma(1982)], short run forecasting model [MNR(1982)], structural and economy wide models [KN(1984), Pandit(1984) and Pani(1984)]. The structural economy wide models vary with a degree of heterogeneity. They follow the tradition of earlier models. But, they are distinct from them by incorporating a specific issue while attempting to structure

the economy wide models. Other kinds of models are policy-oriented [CB(1987)] and exploratory type of models [JS(1990) and RA(1990)].

These models together cover a long period of Indian economy from 1951 to 1988. All the models use annual observations. They are full-fledged and consists of multi-sector and follow simultaneous equation systems for estimation and analytical purposes. All models carry out simulation exercises both static and dynamic to assess the performance of the overall model. Few models follow partial adjustment mechanism. The salient features captured in the models are as follows :

1.1. Monetary Aspects :

The description of banking operations appear in detail basically to determine money supply. However, demand for money is examined following the Quantity Theory framework by specifying the price formation as an inverted money demand function. Further, money demand is disaggregated into demand for currency and demand deposits by incorporating real income, opportunity cost variables, price expectations, government deficit and foreign exchange assets of RBI.

Money supply determination is carried out either through conventional money multiplier theory of money supply process or relating to government deficit or net foreign exchange assets of RBI (RBFA). Among the sources of high powered money(H), the vital role of RBI credit to government (RBCG) is widely recognised. Other sources of H such as currency liability of the government, RBI credit to commercial sector and RBFA are assumed to be exogenous invariably in all models.

1.2. Fiscal Operations :

Varying treatment of fiscal operations are observed in these studies. One set of studies specifies the government operations in aggregative framework with few equations relating the government operations (government revenue and government expenditure) to real income and their own lags. The second category tries to identify the non-random factors that cause the actual and estimated government expenditure and government receipts. Further, government operations are highlighted through the activities of public sector - the volume and allocation of investment in the public sector. And it is proposed to affect output through current demand and potential supply.

On the other hand, the disaggregative analysis captures government operations through fiscal policy with more detailed explanation of government revenue and expenditure, providing an explicit account of the effect of the price level variations. Further, government operations are categorised into current and capital account transactions. They are also classified into developmental and non-developmental transactions in the case of government expenditure and tax and non-tax revenue

and borrowing (internal and external) for government revenues.

1.3. Monetary-Fiscal Link :

The vital link of fiscal operations and generation of monetary impulses through the propagation of government deficit from fiscal to monetary sector either one way or both ways is formulated in many of the models. The link variable is RBCG - an endogenous component of reserve money, which accounts for government deficit. On the other side, the fiscal aggregate is influenced by income, prices etc. Thus the inflation-induced budget deficits leads to raise RBCG and hence the combined money supply increases further pressure on prices.

While, some models make a thorough analysis of the budget constraint, or sources and uses of funds and of budget deficit in the creation of money and related aspects. Others postulate the links through partial adjustment framework, recognising the fact that the government expenditure and revenue have a differential impact on prices.

1.4. Price Movements :

Price level is explained through aggregative analysis adopting monetary approach by specifying inverted money demand function as price equation. On the contrary, structural models follow disaggregated approach to price formation. They avoid exclusive dependence on monetary expansion in explaining price movements. The structural and institutional factors are incorporated in the price equation either to replace the monetary factors or to support them as appropriate. There is no consensus on the form in which money is incorporated in price equation.

However, sectoral as well as aggregative prices are affected by excess liquidity in the economy following Quantity Theory approach. The relative prices are stated to act as equilibriators of demand and supply in agricultural sectors while cost mark-up relations (fixed or varying mark-up over different costs of input per unit of output) are a general rule for industry and services. The cost elements consists of nominal wage rate, prices of imported raw materials and intermediaries and prices of agricultural raw materials.

1.5. Link between Monetary, Fiscal and Price Movements :

An initial budget deficit in part or in whole financed by credit from RBI, increases reserve money and therefore money supply via money multiplier, other things remaining the same. The increase in money supply forces an upward pressure on price level. The increase in price level in turn raises government revenue and expenditure differentially, raising the government deficit in the process - as expenditures adjust at a faster rate towards the target level than revenues and within expenditures, current expenditures adjusts more rapidly than investment expenditures. Hence, the resource gap becomes a positive function of price level. This cycle

continues until new equilibrium of money supply and prices are reached.

In brief, RBCG is the crucial determinant of high powered money, which forms the basis of money supply through money multiplier. And money supply has a strong influence on prices - either sectoral or general, move, by and large, at about the same rate as money supply, given other factors.

This self-perpetuating process of inflation was first studied by Olivera(1967). He questioned whether money supply itself is independent of inflation. This process is examined through partial adjustment mechanism, wherein revenue and expenditure are formulated to follow the partial adjustment process, in which revenues take a longer time to adjust to the target. In this framework, divergence between expenditures and revenues will widen if the partial adjustment coefficient is higher for expenditures and ultimately nominal deficit becomes a function of prices.

The dynamic forces of this process was empirically examined in many studies. For instance, following Olivera, Aghevli-Khan(1978) suggest that government expenditure adjust more rapidly than government revenue to a given change in the price level and as a result, inflation widens budget deficit through RBCG to a larger money supply provoking inflation further. In the Indian context, Sarma(1982) replicated Aghveli-Kahn.

Later, Heller(1980) argues that the existence self-perpetuating process can not be taken for granted, as the following feed backs are ignored in the earlier studies following Olivera :

(i) Output is assumed to be exogenous independent of fiscal policy which overestimates the inflationary pressure as part of government expenditure could increase output both directly and indirectly. In developing countries, production subsidies too influence output

(ii) RBCG is not the sole component which fills the resource gap. Internal and external borrowing also constitute the resource gap and

(iii) Debt and interest payments for a given government expenditure leaves less capital formation, impeding economic growth. The negative feedback effects through debt accumulation is ignored in these studies.

In sum, monetary expansion is fueled by budgetary deficits. Public expenditures not only add to growth due to investment expenditure, but also raises the inflationary pressures as revenues expand faster than expenditures. However, the strength of interdependence relies on the pattern of financing the gap. Greater proportion of RBCG in the resource gap provides a stronger interdependence between money and prices. In such situations, inflation becomes self-perpetuating in character.

1.6. Output Generation :

The real sector in the models are either aggregative or disaggregative in nature. The disaggregative studies divide the real economic activities into primary, secondary and tertiary sectors. Output from each of these sectors are determined separately and then the total output is given as a sum of output obtained from these sectors. On the contrary, the aggregative studies include real money balances as additional argument in the production function, the rationale being the economic efficiency is higher in the monetary economy compared with barter. It embodies two important mechanism for growth - (i) real investment as a stimulus to increase output and (ii) monetary impact on output.

1.7. Link between Monetary and Real Variables :

The interdependence between monetary and real variables are not elaborate in these studies. Very few studies attempt to relate the monetary effects transmitted to real variables through variations in the rate of inflation, rate of interest, absolute and relative price levels. Further, some studies attempt to link the two sectors by postulating the Quantity theory with money affecting price level given the output.

1.8. Interdependence between Monetary, Fiscal, Real and Price Movements :

The analysis rests on the hypothesis that revenues are targeted at GDP in nominal terms, whereas expenditures are targeted at GDP in real terms and both adjust gradually to target. As a consequence, deficit becomes a function of price, its rate of change and also RBCG. The resource gap financed by RBCG is determined by government's fiscal policy management under situations such as :

(i) Resource gap created by the difference between government expenditure and revenue, due to inflationary pressures, can be filled by deficit financing or reduction of capital formation or a combination of both

(ii) If the price rise is a consequence of bad harvest, then government expenditures accommodate subsidies and relief measures which again pushes up the money stock and

(iii) If the government is keen to maintain investment, the only alternative appears to be restoring deficit financing.

However, government plays a dominant role in promoting economic growth by its direct investment. The impact of budgetary deficits due to investment expenditure is more complex than that related with increased current expenditures. The immediate impact of deficits for financing investment on prices may be different from the ultimate effect. It depends on the nature of public investments, its composition, the direct and indirect impulses of these investments on output generation and on private investments, the lags involved and the pattern of the

economy. The inference is that there is an inherent dynamics of inflation and there may be a trade-off between inflation and growth in the short run.

Some other studies examine whether the self-perpetuating process of deficit-induced inflation or inflation-induced deficits is applicable to India incorporating the missing links in Olivera. Having identified the inherent dynamic process, the studies provide a number of conflicting tendencies such as - (i) The initial budget deficit apart from increasing money supply tend to expand domestic debt which increases interest burden, thus increasing expenditure and hence widening the budget deficit and (ii) Real development expenditure enhances the production potential in the economy leading to growth.

Another feature added to this dynamic process is an attempt to link credit and output by introducing real money or credit as an additional variable in the production function besides capital stock. An increase in credit is reflected by monetary expansion. The inflationary impact on monetary expansion can be neutralised to the extent of higher output that credit expansion would have aided to generate. The transmission mechanism of monetary and output impulses works simultaneously to determine price level with partial adjustment over time. The extent of inflation depends upon various elasticities quantifying the relationship among money, output and prices.

1.9. External Sector :

Treatment of external sector is either non-existent or rudimentary in many models. The link between domestic economy and foreign sector are formulated to comprehend the role of trade, balance of payments transactions, which so far, have registered a very small proportion of gross national product. Very few studies attempt to analyse that exports and adverse terms of trade affect aggregate demand and domestic prices.

Further, external sector is specified in aggregative framework, bringing the vital linkages through prices as well as quantities of exports and imports.

On the other hand, import and import prices affect the economic activity, the former in favourable terms and the latter in adverse terms. Import prices have a substantial contribution to domestic prices despite monetary expansion. Further, foreign exchange reserves are related to current account deficits and capital flows.

1.10. Link between Monetary and External Variables :

Treatment of the link between monetary and external sectors are absent in the studies except Pandit(1984). He links the two sectors through the net foreign assets of RBI via high powered money to money stock.

1.11. Interdependence between Monetary, Fiscal and External Sectors :

The inter-relationship among monetary, fiscal and external sectors are

weak in the models. The monetary-fiscal nexus sends impulses to the external sector through net foreign assets of RBI in the sources of high powered money and external borrowing in the deficit financing of the government. Foreign borrowing as well as RBFA are treated as exogenous to the system.

1.12. Link between Monetary, Fiscal, Price, Real and External Variables :

The fiscal and external sector jointly determines the reserves money as other components of reserve money account for less proportion. Given the stock of reserve money, cash reserve ratio, statutory liquidity ratio, the spectrum of interest rates, development of financial institutions and banking practices, the monetary sector determines the money stock, aggregate deposits and total bank credit and also the sectoral distribution of credit. Given the money stock, credit and their interaction with the real sector determines (i) the rate of inflation and (ii) rate of growth.

The real sector receives impulses from the fiscal sector through the reliance on government revenue than expenditure (to a larger extent). These feedback effects are sent to the monetary sector through RBCG and RBFA (in order to fill the resource gap) which together determine high powered money and then money supply via money multiplier. The entire set of interactions, their impulses and feedbacks among these macro economic variables are not dealt in detail in any of the models. Invariably all the models treat that external transactions are determined outside the system.

1.13. Some Econometric Issues :

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It is also known as stock adjustment model. It is provided by Marc Nerlove. It is assumed that there is an equilibrium, optimal, desired or long run amount of capital stock is needed to produce a given output under the given state of technology, rate of interest, etc. Further, it is given that the desired level of capital is a linear function of output. Since,the desired level of capital is not directly observable, it is postulated that the actual change in capital stock (investment) in any given time period is some fraction known as partial adjustment coefficient of the desired change for that period.

In other words, observed capital stock at that time as a weighted average of the desired capital stock at that time and the capital stock existing in the previous period. In sum, it is assumed to adjust partially to the difference between desired and actual value of the variable in the previous period.

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The purpose of carrying out simulation exercise in the models is to assess the performance of the overall model and specific policy results to important macro economic variables. They are also used to study and compare the short run and long run responses of one varaible or set of varaibles to another variable. The static

simulation provides a single period, short run simultaneous solution of the model without any carry-over effects of errors from the previous period.

Dynamic solution is a more effective method of evaluation. The current year's solution of endogenous variables is linked to the estimated values of the previous year, which provided the dynamic solution path of the endogenous variables over the entire period of simulation. In the dynamic simulation, errors get accumulated over time. A large error in the estimation of any endogenous variable in any year gets transmitted throughout the system and affects the magnitude of errors in all the successive years.

2. Monetary Sector

Monetary actions captured in the models under consideration are discussed in two heads - demand for money and supply of money.

2.1.Demand for Money :

The Fisherian analysis of demand for money stresses the medium of exchange function as more important. This equation of exchange states that the amount of money in circulation(M) times its velocity(V) must equal to the number of transactions(T) carried out over a particular period times the average price(P). The Classical believe that velocity do not vary rapidly in the short run even if there is some changes in credit practices and communications.

On the other hand, the Cambridge economists are concerned with the factors determining the amount of money people 'wish to hold' rather 'have to hold' postulated by Fisher. Later, this approach recognises wealth, interest rate and future expectations as important additional arguments in the demand for money function. However, all these factors are assumed to be constant in the short run and hence there is an equal proportionate increase in money and prices.

The Classical economists view that when money supply increases there is an equal, proportionate and instantaneous increase in the price level. Given the only function of money being medium of exchange, whenever money supply expands, the increase in the purchasing power of the people is distributed only among the consumption goods. Any increase in money supply without an equal increase in price level indicates the gap between demand and supply of commodities in the real sector. They view that this gap is only a transitory phenomenon. In the long run, the process becomes automatic that any increase in money supply is taken care of by an equal increase in price level.

Keynes(1950) analysed the demand for money in three motives in which transactions and precautionary demand for money has a stable and positive relation with income level. The speculative demand for money is inversely related to rate of interest. Keynes assumes that people keep the money

either in the form of bonds or cash balances as the future interest rate is certain. Other substitutes of money are not considered by him.

Later, Baumol(1952) reformulated the transactions demand for money function emphasising the role of business inventory control. The inventory of money helps to facilitate exchange. Otherwise, this inventory of money is an costly affair for the wealth holder as (i) interest rate is foregone and (ii) it incurs brokerage cost. And thus, the solution focuses on the determination of choice of inventory of money and minimising the brokerage cost as any rational individual will try to maximise his income and minimise the cost.

In the Keynesian analysis of speculative demand for money, the future rate of interest is certain and hence the speculator holds money in the form of either cash or bonds. When the future interest rate is not certain, Tobin introduces the choice of a portfolio holder that he tries to maximise his income or wealth by adjusting his portfolio in ample ways (each having a different cost associated in shifting one asset to another) after discounting the risk involved. Thus, Tobin's theory of speculative demand for money by an individual depends upon the individual wealth and the rate of interest.

Friedman(1959) considers money rendering a variety of services though the main service being an abode of purchasing power temporarily. The demand for money is specified as a function of ratio of human to non-human wealth, price level, interest rate and expected rate of change as a budget constraint. In the empirical analysis, he has found real income and interest rates are the only significant variables. Basically the money demand function is a derived demand function. However, the conventional money demand function includes real income, price level and interest rates as arguments.

Many of the models under consideration follow the Classical Quantity Theory specification for demand for money. In general these models [Sarma(1982), JS(1990) and RA(1990)] explain the price level through inverted money demand function. No seperate treatment for demand for money is found in these models.

Pandit(1984) and CB(1987) follow by and large similar specifications. Both explain the money demand function in real terms. Pandit specifies the real demand for money as a function of real income, bank lending and expected rate of inflation. CB explains real currency demand and real demand for demand deposits are the function of the real income and their own lags. However, Pandit incorporates bank lending and expected inflation rate as additional arguments in CB's specification.

On the other hand, Pani(1984) gives change in currency demand as a function of budget deficit, change in foreign assets of RBI and government borrowing. Demand for aggregate deposits as a function of

external debt servicing, which is given as a residual of bank reserves and impounded deposits. However, MNR(1982) and KN(1984) did not pay attention for a separate treatment for demand for money rather, they focus on money supply. Statement 1 presents the specification of demand for money in the models under consideration.

2.2. Supply of Money :

In Classical as well as Keynesian analyses, money supply is treated as exogenous. The later developments in the literature suggests balance sheet or accounting identity, portfolio approach and money multiplier theory of money supply process. The balance sheet approach gives the assets and liabilities of a central bank. It merely exhibits the accounting relationship. The portfolio approach explains the demand for and supply of portfolio of a central bank. Among the different approaches, the money multiplier approach is widely recognised in the literature.

Conventionally, it is explained with an identity which is of the form:

$$M = mB \ldots (1)$$

where M is money stock measure (either narrow or broad), m is the multiplier coefficient and B is the base money. Any change in M is explained either through m or B. This approach assumes that B is exogenous - it is under the immediate purview of the monetary authorities. Thus, changes in M can be brought out by changing B. The money multiplier can be derived by substituting the components of M and B. Ultimately, it can be explained as a function of currency to deposit ratio and reserve to deposit ratio. Equation (1) can be written in the form of :

$$m = M/H \ldots (2)$$

in order to find out the determinants of money multiplier. Substituting M = C + D (in narrow terms) and H = C + R, the final form is expressed as:

$$m = (C/D + 1)/(C/D + R/D) \ldots (3)$$

where C = currency with the public, D = demand deposits with the banks, R = reserves held with RBI by the banks and cash reserves with banks.

The functional relationship between currency to deposit ratio and reserve to deposit ratio can be explained following simple Classical macro economic theory. The currency to deposit ratio is expressed as a function of ratio of consumption to income, the opportunity cost variable - rate of interest assuming that demand for currency is strongly linked with consumption and deposits with income. This ratio depends primarily on the behaviour of the public.

The reserve to deposit ratio is related to cash reserve ratio and bank reserves and to rate of interest. This ratio depends on the behavioural choices of banks. When there is an increase in interest rate - (i) the currency to deposit ratio declines. As a result, the value of money multiplier

increases and (ii) the reserve to deposit ratio declines. The decline in reserve to deposit ratio has an impact of increasing the value of money multiplier. Thus, increase in the rate of interest increases the value of money multiplier and there exists direct relation between the two.

As already noted, in order to control money supply growth rates which implies controlling inflation, two ways are possible according to theory - (i) controlling through interest rate and (ii) controlling through high powered money. The theory suggests that both can not be operated simultaneously. Controlling the money supply through interest rate is good when the money demand function is more stable than the money supply function. When the money supply function is more stable than the money demand function, the other possibility is controlling through base money.

In India, since interest rates are administered, full-fledged capital and money markets are absent and also the empirical literature suggests that money demand function is less stable than the money supply function, controlling through base money seems to be a better choice. However, base money is accommodative of the government deficit and hence controlling the base money depends on the maneuverability of the monetary authorities.

In most of the studies money multiplier is assumed to be stable in the long run. Since money multiplier is found to be stable [see Chitre (1986)], any variation in money stock is due to changes in base money. The sources of variation in high powered money is given from the RBI's balance sheet identity as :

$$H = RBCG + RBCC + RBFA - RBNML \quad ... (4)$$

where RBCG = RBI's credit to government, RBCC = RBI's credit to commercial sector and RBNML = RBI's net non-monetary liabilities.

Few models [MNR(1982) and RA(1990)] follow this conventional approach. MNR proposes to determine the money multiplier endogenously by estimating the three asset ratios. High powered money is specified by the identity in usual way [see MNR(1982), KN(1984), CB(1987) and RA(1990)]. In these models, RBCC, RBFA and RBNML are assumed to be exogenous. All these models explain RBCG in detail and bring out its link with fiscal sector. Many models relate RBCG solely to budget deficit [Sarma(1982), MNR(1982) and KN(1984)]. KN(1984) treat RBCG as endogenous by relating to its own lag.

However, Pandit(1984) treat RBCG as exogenous which forms a crucial link between fiscal and monetary sectors. But, he specifies net foreign assets of RBI as endogenous and captures the link between monetary and external sectors. He explains money supply through M3-money identity. This model determines each component of M3-money endogenously. JS(1990) relates money supply in a different manner -

relating the budget deficit and lagged value of money supply. The budget deficit feeds back into monetary sector from fiscal sector. Statement 2 presents the specification of money supply in the models under consideration.

3. Fiscal Sector :

The treatment of fiscal sector is explained through two approaches -(i) aggregate analysis along neo-keynesian lines, and (ii) disaggregate analysis. Aggregate analysis does not exhibit much of inflationary potential [see Rakshit (1987)]. All models under consideration follow disaggregate analysis except Sarma(1982). Fiscal sector is discussed under three heads - government expenditure, government revenue and budget deficit.

3.1. Government Expenditure :

Sarma(1982) adopts aggregate expenditure approach and explains the model by relating exogenously determined real income and lag of the dependent variable to government expenditure. Most of the models [MNR(1982), KN(1984), Pandit(1984), Pani(1984), CB(1987) and RA(1990)] disaggregate government expenditure as current, revenue and capital expenditure. In many models [KN(1984), CB(1987) and RA(1990)] current and revenue expenditure are specified as a function of real income and the lag of the dependent variable.

However, MNR(1982) specifies government revenue expenditure differently as a function of estimated government expenditure and ratio of net external loans to budget deficit. Pandit(1984) attempts to divide government current and revenue expenditure into government consumption expenditure and other current expenditures. Government consumption expenditure is related to total per capita current revenue and per capita consumption expenditure. The other current expenditure is related to changes in debt, changes in other current expenditure and revenue from foodgrain output (prices of foodgrains are multiplied by the output of foodgrains).

JS(1990) is distinct from other models as it disaggregates government expenditure into developmental, non-developmental and interest payments. Developmental expenditure are treated as exogenous. Non-developmental expenditure is specified as a function of real income, price level and lag of the dependent variables. Interest rate is related to lag of debt.

In few models [Pani(1984) and CB(1987)] government expenditure is related to exogenous government investment expenditure as a function of prices in the secondary sector, ratio of net external loans to budget deficit and estimated government capital expenditure. KN(1984) explains government expenditure as an identity by summing up public investment and capital revenue of public sector. Pandit(1984) also specifies government capital expenditure as an identity by adding up government saving, domestic borrowing, foreign borrowing,

foreign assistance and budget deficit. RA(1990) treats government expenditure as exogenous. Statement 3 exhibits the government expenditure specifications in fiscal sector.

3.2. Government Revenue :

Few models [Sarma(1982), Pani (1984) and CB(1987)] adopt aggregate revenue approach. Sarma(1982) explains government revenue by relating nominal income and lag of the dependent variable. Pani(1984) specifies government revenue as a function of nominal income. On the other hand, few models [MNR(1982), KN(1984), Pandit(1984), CB(1987), JS(1990) and RA(1990)] attempt to follow disaggregate analysis.

Few models [MNR(1982) and JS(1990)] disaggregate government revenue as tax and non-tax receipts and non-tax receipts are treated as exogenous. MNR(1982) specifies tax receipts as the sum of individual taxes such as receipts from custom duties, union excise duties, personal income tax and corporate income tax. Each of these taxes are estimated endogenously. This model does not include the receipts from internal and external borrowing, deficit financing and government saving in government revenue.

KN(1984) specifies government current receipts as a function of real income and lag of the dependent variable. Domestic borrowing is related to government capital and current expenditure, government current saving and foreign borrowing. Government saving is specified as a function of the difference between government revenue receipts and government current expenditure. This model fails to incorporate the source of deficit financing in government revenue.

Pandit(1984) shows government revenue as the sum of direct tax receipts, indirect tax receipts and other current receipts. Direct and indirect receipts are given as a function of real income from non-agricultural sector. Government saving is given as the sum of direct taxes, indirect taxes, other current receipts, capital consumption allowances and subtracting the sum of government consumption and other current expenditure. This model fails to include the sources of revenue from domestic and foreign borrowing, deficit financing and government capital receipts.

CB(1987) relates government revenue to nominal income and exogenously determined effective tax rates and its own lag. It specifies government capital receipts as a sum of government market borrowing and exogenously determined non-market borrowing and foreign borrowing. Government market borrowing is related to total bank deposits and its own lag.

JS(1990) specifies government revenue as the sum of tax and non-tax receipts. Both are related to real income, price and their own lag values. This model misses to incorporate many items in the source of government revenue such as

government current and capital receipts, internal and external borrowing, government saving and deficit financing.

RA(1990) presents government revenue as the sum of current and capital receipts. Government capital receipts are treated as exogenous. Current receipts are disaggregated into government market and non-market borrowing and government external borrowing. Government external borrowing is treated as exogenous. Government market borrowing is given as the sum of government investment in securities in banks and government investment in non-bank institutions. The change in government investment of securities in banks is related to the changes in total deposits of the banks.

Government non-bank investment of securities is related to nominal income. This model also misses to include the source from deficit financing. All these models treat non-tax revenue as exogenous. Disaggregation of non-tax revenue into borrowing, deficit financing, government saving and government capital receipts would give a clear picture. Among these sources, deficit financing must be given greater attention as it generates more inflationary pressures in the economy.

3.3. Budget Deficit :

In India, budget deficit is the source of inflation besides money supply. Majority of the models [Sarma(1982), MNR(1982), Pandit(1984), CB(1987), JS(1990) and RA(1990)], identify budget deficit as the difference between government revenue and government expenditure. Pandit(1984) does not provide any explicit specification for budget deficit. KN(1984) specifies budget deficit in a different manner - as the difference between government capital expenditure and the sum of government public sector saving, other domestic borrowing and foreign borrowing.

Most of the models link budget deficit from fiscal sector through RBI credit to government in monetary sector, which serves as a link variable between the two sectors. Few models [Sarma(1982) and MNR(1982)] specifies that deficit is solely financed by RBI credit to government. The other sources of financing the budget deficit such as domestic and foreign borrowing, government saving are ignored in these models. Few studies [Pandit(1984), Pani(1984), CB(1987), JS(1990) and RA(1990)] consider domestic borrowing but treat foreign borrowing as exogenous. These models also ignore government saving and government capital receipts as the sources of financing budget deficit. Statement 5 reports the specification of budget deficit in various models.

4. Price Movements :

Broadly there are two views regarding the mechanics of inflation - monetarist and structuralist.

4.1. Monetarist View

The Classical Quantity Theory tradition stresses inflation is a monetary pheno-

menon. Price behviour analysed in a simple Quantity Theory framework assumes:

(i) the rate of increase in the general price level is approximately equal to the rate of increase in money supply per unit of aggregate real output,

(ii) money supply is exogenous and can be fixed by the authorities at any level and it is predictable and controllable in terms of monetary policy instruments,

(iii) unidirectional causal flow from money to price and not the reverse can be observed and

(iv) there is no long run effect of money on output. This indicates that monetary effects on output and employment would be transitory and not permanent.

However, difference of opinion persists as to how quickly the effect is transmitted, how independent the money supply is from the determinants of output and what measure of money supply to use.

4.2. Structuralist View :

Non-monetarist view that price rise is a much more complex phenomenon. It can not be controlled by a mere regulation of money supply growth rate. The structural model explains behaviour of prices in developing countries based on the structural disequilibrium in the growth process observed in Latin American countries. With necessary alterations, these models have been applied to explain inflation in Asian and African countries. They emphasis some basic constraints in the growth process of developing countries.

The primary sector in these countries, providing food and agricultural raw materials, has low income and price elasticity of output. When income of the secondary sector, producing manufacturing goods rises, there exists a gap between demand for and supply of foodgrains. This excess demand leads to rise food price - wage rate - manufacturing price nexus. Deficit in foreign exchange reserves in developing countries accounts for a high price elasticity of exports mainly of primary goods and on the other hand, imports consisting primarily capital goods have low price elasticity.

The other major factors behind inflation in these countries is low savings and high investment propensity in both government and private sectors. Thus, the financing of development requires credit expansion from banks to government resulting excess money supply in the economy. In an extreme form, this view holds that if administered prices are constant, money supply and output move together and inflation is greater and output growth is higher. How much the price level responds to increase in administered prices or higher output growth depends on how quickly wages adjust to inflation.

Inflation in India is explained through these two approaches - either in an aggregate framework with single equation following Quantity Theory framework or in a disaggregated manner through multi equations with structural factors. Some of the models [Sarma(1982), JS(1990) and

RA(1990)] are of monetarist type. However, CB explains price level by incorporating effective tax rate in the function. These models explain inflation in a conventional inverted demand for money framework as price equations.

KN(1984), Pandit(1984) and Pani(1984) try to explain inflation through structuralist approach. They adopt disaggregate price behaviour through multi equation model. KN explains the price sector in detail with 12 equations. The price sector is divided into prices of agricultural goods, industrial goods, energy items, infrastructure and prices in tertiary sector.

Pandit(1984) also follows disaggregate approach. The model provides an elaborate treatment of price movements with 17 equations. It divides the price sector into prices of food articles, raw materials, manufacturing and mining, textiles, energy items and prices of minerals. Whole sale price index is given by the sum of all of these items.

Pani(1984) divides the price sector into prices of food articles, raw materials, manufacturing and mining. Whole sale price index is given as a function of nominal money supply, prices of food items and a specially constructed index of administered prices. Finally general price level is estimated by including all these items. Though these models are disaggregated and many structural variables appear, these models seem to ignore the influence of government deficit in explaining inflation. Statement 6 shows the specification of price movements in the models.

5. Real Sector :

The Quantity Theory of money in its extreme form argues that money has no impact on output and therefore, an increase in money supply results in a proportionate increase in the price level. Monetarist maintain that changes in money supply have a direct effect on expenditure, and therefore, on national income and thus a change in money supply produces change in GDP. They question the reliability of the Keyenesian model, since the IS/LM model typically postulates that the price level can be assumed to be fixed.

On the other hand, Keynesian hold the view that changing the supply of money works indirectly on the level of aggregate income by altering interest rates, which in turn influences the level of investment and credit in the economy. They maintain that the effectiveness of monetary policy depends on the elasticity of the supply and demand for money with respect to the rate of interest and the responsiveness of consumption and investment expenditure to changes in the rate of interest. Further,the Keynesian analysis, on the assumption of stickiness in prices argues that an increase in money supply will lead to a fall in the rate of interest, both nominal and real, stimulating investment through which a multiplier process, would lead to an increase in real income.

There is no unanimous view on how changes in money supply ultimately affect the real economy. Perhaps, the reality lies somewhere in between these two extremes. Money has an impact on both output and prices. The process of money creation is the process of credit creation. Since credit facilitates the production process, it has favourable impact on output. But, at the same time, the increased money supply increases upward pressure in prices. Hence, the output effect and price effect must be taken together to judge the overall impact on the economy. However, when money supply increases both prices and output level increase but not in the same proportion.

Few models [Sarma(1982) and MNR(1982)] treat real sector as exogenous. KN(1984) disaggregates the output in each sector such as agricultural, industrial, infrastructure and tertiary sectors. And the final output is derived from the sum of all these individual sectors' output. Similarly, Pandit(1984) identifies output in agricultural and non-agricultural sectors. It links real and fiscal sectors. These two models does not relate real output to price movements, whereas JS(1990) made an attempt to link real sector to fiscal and price sectors. This study tries to estimate real output in a different manner - by measuring capacity output and capacity utilisation. But, it does not relate real and monetary sectors.

Pani(1984) explains the real sector in detail with 8 equations disaggregating output into agriculture (output from foodgrains and non-foodgrains), mining and manufacturing, unregistered manufacturing industry, tertiary (transport and communication) and other services.

Agricultural income is given as a function of agricultural output. Income from manufacturing and mining are specified as a function of capital stock in mining and manufacturing, the ratio of government non-consumption expenditure to price deflator of gross domestic product, and government's non-investment expenditure. Unregistered manufacturing industrial income is related to income from manufacturing industries and capital stock in unregistered manufacturing industry. Income from tertiary sector is given as a function of income from agricultural and manufacturing and capital stock in the tertiary sector.

CB(1987) also adopts a detailed and disaggregated specification of real sector with 49 equations. It relates real output to gross sown area, total capital stock and imports of raw materials. Total capital stock is given as the sum of government and private capital stock. Government capital stock is given by an identity as the sum of lag of government capital stock and net fixed capital formation of the government. In the same way, private capital stock is given as lag of the dependent variable and net private fixed capital stock. Gross private fixed capital formation is related to government capital stock, annual average yield on corporate sector, foreign exchange reserves and private stocks.

RA(1990) attempts to distinguish from the existing models. Real output is estimated by a production function with capital stock and real money stock. Capital stock is divided into three sectors - public sector, private corporate sector and private non-corporate sector. Public sector capital stock is estimated by relating capital expenditure of the government. Capital stock of private corporate sector is determined by relating public capital stock, lag of the dependent variable and lag of real income. This model relates real, monetary and price sectors. Statement 7 portrays the specification of real sector in the selected models.

6. External Sector :

External sector explains the trade flows and accounts for current and capital transactions with the rest of the world. It brings out the extent of dependence of domestic economy on external sources. In a country like India, with much dependence on imports, it is essential to bring out the interrelationship among the external sector with other sectors in the economy. Since, Indian external sector is closed for a long time, a systematic model for this sector is not found in the literature.

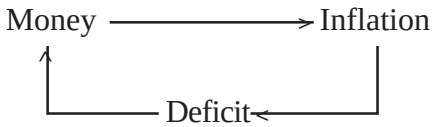
Many models [Sarma(1982), MNR (1982), KN(1984), JS(1990), and RA(1990)] treat external sector as exogenous. Pandit(1984) links the external sector with monetary sector through Reserve banks foreign exchange assets. The real import demand for non-food items is related positively to government investment and the private corporate sector, negatively to unit value index of non-food imports and domestic price level of the secondary sector products and positively to the stock of net foreign exchange assets of RBI.

The deflated value of exports depend on export prices relative to those of India's competitors and the world demand for imports. World export prices are used as determinant of exports for any specific country restricting to Asian countries only (excluding China) and assuming that these countries are India's real competitors. Pani(1984) describes the exports as function of world gross domestic product. Exports of merchandise is specified as a function of whole sale price index and its lag. Imports are related to net domestic product and deflated prices of imports.

CB(1987) presents the foreign sector in two equations. The real imports of raw materials is given as a function of real income, lag of the dependent variable and lag of the real exports. Real exports are related to world income and lag of the dependent variable. Statement 8 exhibits the specifications of external sector in the models.

7. Concluding Remarks :

The nexus between the three macro variables - deficit, money and prices involve complex operations in the economic activities. The link can be expressed in a simple flow chart as :



In the above displayed simple chart, inflation is linked to money growth. The money growth itself increases due to monetisation of deficit. Thus, controlling inflation has to be aimed at controlling the deficit through fiscal policy rather than the monetary policy. The better choice would be synchronisation of fiscal and monetary policies for curtailing inflation.

The other argument in the literature views that since monetisation of deficit expenditure is carried out for public investment, any check on that is at the cost of growth and income. Moreover, India is still in the development phase, such curb on public expenditure will hamper the development process. In this context, analysing the link between money, credit and income besides the link between money, price and deficit must be given emphasis as money is essentially credit-driven and endogenously determined. If linkage between money, credit and income can be established, then it is essential to regulate the growth of credit, its sectoral distribution and more important to the end use of credit.

Shetty(1991) argues that the emphasis on price stability as the primary goal of monetary policy has ignored the broader and dynamic role of money and credit in generating employment and output. He further views that while focusing on the government's fiscal deficit, the other aspects such as nature of deficit, structure of government spending, constituents of revenues will be more inflationary.

Further, he contends that primary cause of inflation is from non-monetary factors. To quote from his study, "As Prof.Sukhumoy Chakravarty has emphasised, pure statistical evidence is not enough to judge if causation runs from money to prices. A more appropriate approach should be to focus on credit and as Prof.Kaldor argued the vagaries of money supply do not ensure the supply of the right quantum of credit for the right sectors" (pp.246-247). Thus, a fresh approach towards the entire economic scenario and monetary/credit policy in particular is germane.

AREAS FOR FUTURE RESEARCH :

A careful study of the models surveyed suggests the following areas for further research work :

Demand for money raises a number of complicated analytical and empirical issues, central one being, identifying the stable money demand function. As the system develops with more financial institutions and money having a number of substitutes as well as performing complex number of functions, explaining a satisfactory money demand function requires additional arguments which captures those changes in the system. In the Indian context, identifying a stable money demand function is a difficult task as the economy has gone through

various structural imbalances, but it is germane. Much effort is needed to incorporate the following factors for explaining a satisfactory demand for money function :

(i) development in the financial sector

(ii) bringing the non-monetary activities into the monetary stream

(iii) bringing the non-banking financial intermediaries into the organised monetary structure

(iv) fluctuation in the agricultural production, subsidies on food and fertilizers and food procurement

(v) preference of the people to hold idle cash balances is more in India and also hoarding money in the form of gold and silver ornaments and

(vi) black money.

Financial deepening, role of financial institution and how these institutions influence in the short and long run movements in the level of economic activity could be studied.

The impact of financial sector reforms on monetary sector in particular and on general economic activities in general could be analysed.

Reduction in government spending has two effects - (i) on the flow of goods and services and money demanded and supplied and (ii) on the stock that it will effect the private sectors' wealth position. The reduction in money supply consistent with a cut in government spending can influence real output and/or prices. This will determine whether the nominal value of budget deficit increases or decreases with the decline in money supply. The absolute size of the government sector depends on the political set up. The decision to reduce government spending, therefore, depends basically on the role of government and also the efficiency of markets and how quickly they clear. To the extent that government bureaucracies are inefficient, government spending can be cut if these can be identified and eliminated which may involve privatisation. An empirical attempt on these lines would be welcomed by the policy makers.

The link from prices to other macro economic variables are not dealt in detail to capture the transmission channels from prices to other economic activities could be examined.

Much attention needs to be devoted to trade and balance of payments. A detailed external sector dealing with trade flows, current and capital transactions with the rest of the world are necessary to comprehend the extent to which the domestic economy is open to external factors. However, foreign exchange constraints, regulated imports and related trade restrictions have an impact on economic growth. The gaps in the demand and domestic supply could be taken up for further research.

In recent periods, with the ongoing structural adjustment programmes, substantial amount of changes have taken place in

foreign exchange markets, international financial flows and interdependence of economies. This is an area which needs some firm empirical results to enable for formulating suitable policy actions. Further, an attempt can be made to compare the present situation and its effects on economic activities with the earlier regulated and restricted trade practices.

All the models under consideration by and large have confirmed the presence of dynamic monetary-fiscal nexus, wherein the net RBCG formed the crucial link between these two sectors. However, this framework does not provide scope for policy simulations with respect to monetary and credit policies. Hence, an appropriate appraoch to suit for policy simulation is warranted.

The links between basic economic activity, credit and output generation are rarely formulated. Though an attempt is made, they are not based on well established theoretical foundations as the theory on demand for credit for production purposes or demand for funds for investment is neither well postulated nor empirically well tested for developed countries as well. This makes the adoption of the existing theories with appropriate modifications to suit Indian conditions, where a dual credit system with an unorganised market funds prevail. In addition to this, administered interest rates create hardships for a proper analysis of the role of interest rates as an allocative mechanism of credit in an optimal way. The area for future research on this lines could be to analyse the role and sectoral distribution of credit and their interactions with the economic activities will be useful for policy makers.

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APPENDIX - 1

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Endogenous Variables

BD	= Budget deficit.
C	= Currency with the public.
CITA	= Corporate income tax (estimated).
CPI	= Consumer price index.
CUDA	= Customs duties (estimated).
D	= Total bank deposits.
DB	= Domestic borrowing.
DD	= Demand deposits.
DER	= Government domestic expenditure (real).
DS	= Deposits of all scheduled commercial banks.
DTR	= Direct tax receipts.
EX	= Exports.
EXM	= Total exports of merchandise.
EXR	= Total real exports.
g	= Ratio of borrowing from Reserve Bank by banks.
GBBS	= Government investment of securities in banks.
GBNB	= Government borrowing from non-bank financial institutions.
GCE	= Government current expenditure.
GCNE	= Government consumption expenditure.
GCR	= Government current revenue.
GE	= Government expenditure.
GER	= Government expenditure (real).
GIE	= Government investment expenditure.
GKE	= Government capital expenditure.
GKEA	= Government capital expenditure (actual).
GKEF	= Gross fixed government capital formation.
GKR	= Government capital receipts.
GMB	= Government market borrowing.
GR	= Government revenue.
GRE	= Government revenue expenditure.
GREA	= Government revenue expenditure (actual).
GRR	= Government revenue receipts.
GS	= Government saving.
$\bar{H}$	= Adjusted reserve money.
H	= Reserve money.
HPD	= High powered deficit.
IA	= Index of agricultural production.
IDTR	= Indirect tax receipts.
IM	= Imports.
IMNF	= Imports of non-foodgrains.
IMR	= Imports of raw materials.
INTN	= Nominal interest rates.

k = Ratio of currency to deposits with the public.

KR = Capital stock.

m = Money multiplier.

M = Nominal money stock.

M1 = Narrow money.

M3 = Broad money.

NINDEN = Nominal non-interest non-developmental expenditure.

NTR = Non-tax receipts.

P = General price level.

PCF = Price deflator for gross domestic capital formation.

PE = Prices of energy items.

PF = Prices of foodgrains.

PG = Implicit gross domestic product deflator.

PITA = Personal income tax (estimated).

PM = Prices of manufacturing and mining sector.

PR = Prices of raw materials.

PT = Prices of textiles.

r = Ratio of reserves to deposits with the banks.

RBCG = Net Reserve Bank credit to government.

RBFA = Net Reserve Bank's foreign exchange assets.

TB = Trade balance.

TR = Tax receipts.

UEDA = Union excise duties (estimated).

WPI = Wholesale price index.

YND = Net domestic product.

$\hat{YR}$ = Capacity output.

YR = Net domestic output.

YRA = Output from agriculture.

YRF = Output from infrastructure.

YRI = Output from industry.

YRM = Output from mining and manufacturing.

YRMF = Output from mining, fishery and forestry.

YRNA = Output from non-agriculture.

YRNF = Output from non-foodgrains.

YRT = Output from tertiary sector.

YRU = Output from unregistered manufacturing industry.

Exogenous Variables

AF = Per capita availability of food-grains.

AFI = Index of area under foodgrains.

AID = Foreign assistance.

ANFI = Index of area under non-foodgrains.

B = Total borrowing.

BCC = Bank credit to government.

BL = Bazar bill rate.

BR = Bank rate.

BR = Bank reserves.

CA = Cultivated area.

CCNA = Capital consumption allowance.

CITE = Corporate income tax (Estimated).

CLG = Currency liability of the Government.

CRR = Cash reserve ratio.

CRT = Rate of corporation income tax.

CTP = Capital transfer of public sector.

CUDE = Customs duties (Estimated).

CURT = Rate of custom duties.

CUTL = Capacity utilisation.

DEVN = Nominal developmental expenditure.

DEVR = Real developmental expenditure.

DI = Impounded deposits.

DT = Debt.

DS = Debt. servicing (external).

ETR = Effective tax rates.

FB = Foreign borrowing.

GB = Government borrowing outside the RBI.

GDP = Gross domestic product.

GDPR = Gross domestic product (real).

GNMB = Government non-market borrowing.

GOCE = Government's other current expenditure.

GPS = Government public sector saving.

GSA = Gross sown area.

HSS = Household saving.

IAF = Irrigated area under foodgrains.

ICRR = Incremental cash reserve ratio.

INA = Index of non-agricultural production.

INF = Index of non-foodgrains.

INFM = Index of non-foodgrains imports.

KAR = Index of gross capital stock in agriculture.

KF = Capital investment in infrastructure.

KGR = Government capital stock in the public sector.

KI = Capital investment in industry.

KPCR = Capital stock in the private corporate sector.

KPOR = Private non-corporate capital stock.

KPR = Capital stock in the private sector (real).

KT = Capital investment in tertiary sector.

KTR = Capital stock in tertiary sector.

KUR = Capital stock in unregistered manufacturing industry.

N = Population.

NB = Number of bank branches in the country.

NEXLR = Ratio of net external loan to budget deficit.

NRB = Number of rural bank branches.

OCR = Other current receipts.

OD = Other deposits.

OGKE = Other government capital expenditure.

π = Expected rate of inflation.

PAD = Potential impact of changes in administered prices.

PI = Public investment.

PITE = Personal income tax (Estimated).

PMN = Prices of minerals.

PPCY = Private per capita income.

PRT = Personal income tax rate.

PY = Productivity.

RB = Borrowing rate.

RBCC = Reserve Bank's credit to commercial sector.

RBNML = RBI's net non-monetary liabilities.

RG = Rate of return on government securities.

RL = Lending rate.

RTD = Time deposit rate.

SF = Availability of foodgrains.

UEDE = Union excise duties (Estimated).

URT = Rate of union excise duties.

W = Wage rate.

WF = Weather index of foodgrains.

WN = Weather index of non-foodgrains

WPF = Wholesale price index of foodgrains.

YN = Nominal national income.

APPENDIX - 2

It presents the statements of various specifications in different sectors in the surveyed models. 'D' indicates change of current year value from the previous period value. The variables in bold letters represent exogenous variables.

Statement – 1

Monetary Sector - Demand for Money

Model	Specification	No. of Equations	Period of study
Sarma (1982)	Inverted Money demand function		61–62 to 79–80
M N R (1982)	_____		51–52 to 79–80
K N (1984)	_____		61–62 to 79–80
Pandit (1984)	$M1/P = f\ (YR,\ (\mathbf{M1/P})_{-1},\ \mathbf{BL},\ \boldsymbol{\pi})$ $C/P = f\ (YR,\ (\mathbf{C/P})_{-1},\ \mathbf{BL},\ \boldsymbol{\pi})$ $DD/P = f\ (YRNA,\ (\mathbf{DD/P})_{-1},\ \mathbf{BL},\ \boldsymbol{\pi})$	4	50–51 to 77–78
Pani (1984)	$\Delta C = f\ (BD,\ \Delta\mathbf{RBFA},\ GB)$ $D = f\ (DS)$ $DS = f\ (\mathbf{BR - DI})$	6	69–70 to 81–82
C B (1987)	$C/P = f\ (\Delta YR,\ (\mathbf{C/P})_{-1})$ $D/P = f\ (YR,\ \mathbf{RID},\ (\mathbf{D/P})_{-1})$	2	62–63 to 83–84
JS (1990)	Inverted Money demand function		70–71 to 87–88
R A (1990)	Inverted Money demand function		61–62 to 84–85

Statement – 2

Monetary Sector - Supply of Money

Model	Specification	No. of Equations	Period of study
Sarma (1982)	$\Delta M = f\ (BD, \Delta \mathbf{BCC}, \Delta \mathbf{RBFA})$ (+ + +)	2	61–62 to 79–80
M N R (1982)	$M3 = [(1+k)/(k+r+g)]H^*$ $k = f\ (\mathbf{NB}, (\mathbf{NRB/NB}), \mathbf{RTD})$ (– – +) $r = f\ (\mathbf{CRR, ICRR, RB, RL, RG})$ (+ + + – –) $g = f\ (\mathbf{CRR, ICRR, RB, RL, RG})$ (+ + + – –) $H^* = C + \mathbf{BR} - \mathbf{RBCC}$ (liability side) $H^* = \mathbf{RBCC} - \mathbf{RBNML}$ (asset side) $\Delta RBCG = f\ (BD)$ (+)	8	51–52 to 79–80
K N (1984)	$M = f\ (H, \mathbf{M}_{-1})$ (+ +) $RBCG + \mathbf{CLG} = (RBCG + \mathbf{CLG}_{-1}) + HPD$ $RBCC = f\ (\mathbf{RBCC}_{-1})$ (+) $HPD = f\ (BD - DB - \mathbf{FB})$	5	61–62 to 79–80
Pandit (1984)	$M1 = f\ (H, \mathbf{RL})$ (+ +) $DH = f\ [(\mathbf{RBCG}+RBCG_{-1}), (DRBFA+DRBFA_{-1})]$ (+ +) $\Delta BCC = f\ (\Delta H, \Delta H_{-1}, (\mathbf{RL-BR}))$ (+ + +)	3	50–51 to 77–78
Pani (1984)	$M3 = C + D + \mathbf{OD}$	1	69–70 to 81–82
C B (1987)	$M3 = f\ (H)$ (+) $H = RBCG + \mathbf{RBCC} + \mathbf{RBFA} - \mathbf{RBNML}$ $RBCG = \Delta RBCG + \mathbf{RBCG}_{-1}$	4	62–63 to 83–84
JS (1990)	$M = f\ (BD, \mathbf{M}_{-1})$ (+ –)	2	70–71 to 87–88
R A (1990)	$M3 = \mathbf{m} * \mathbf{H}$ $\Delta D = f\ (M3)$ (+) $H = RBCG + \mathbf{RBCB} + \mathbf{RBFA} + \mathbf{CLG} - \mathbf{RBNML}$	4	61–62 to 84–85

Statement – 3

Government Expenditure

Model	Specification	No. of Equations	Period of study
Sarma (1982)	GER = f (**GDPR, GER**$_{-1}$)	1	61–62 to 79–80
M N R (1982)	GREA = f (**NEXLR, GRE**) GKEA = f (**PI, NEXLR, GKE**)	2	51–52 to 79–80
K N (1984)	GCE = f (YR, **GCE**$_{-1}$) GRE = f (YR, **GRE**$_{-1}$**, W**) GKE = **PI + CTP**	3	61–62 to 79–80
Pandit (1984)	GCNE = f (GCR/**N**, GCNE/**N**) GOCE = f (ΔDT, ΔGOCE, (PF.YRF)) GIE = GS + DB + **FB** + **AID** + BD	3	50–51 to 77–78
Rani (1984)	GE = GCE + GKE GKE = f (GIE) GCNE = f (**GCNE**$_{-1}$)	2	69–70 to 81–82
C B (1987)	GE = GCE + GKE GCE = f (YN, **GCE**$_{-1}$) GKE = GKEF + **OGKE**	3	62–63 to 83–84
JS (1990)	GE = **DEVN** + NINDEN + INTN NINDEN = f (YR, P, **NINDEN**$_{-1}$) INTN = f (**DT**$_{-1}$)	3	70–71 to 87–88
R A (1990)	GE = **GKE** + GCE GCE = f (YR, **GCE**$_{-1}$)	2	61–62 to 84–85

Statement – 4

Government Revenue

Model	Specification	No. of Equations	Period of study
Sarma (1982)	$GR = f(\mathbf{GDP}, \mathbf{GR_{-1}})$	1	61–62 to 79–80
MNR (1982)	$GR = TR + \mathbf{NTR} + GKR + GRR$ $TR = CUDA + UEDA + PITA + CITA$ $CUDA = f(\mathbf{PIM, M, CURT, CUDE})$ $UEDA = f(\mathbf{PI, YRI, URT, UEDE})$ $PITA = f(\mathbf{PI, YRI, PRT, PITE})$ $CITA = f(\mathbf{PI, YRI, CRT, CITE})$	6	51–52 to 79–80
KN (1984)	$GCR = f(YR, \mathbf{GCR_{-1}})$ $DB = f(BD + \mathbf{FB})$ $GS = f(GCR - GCE)$		61–62 to 79–80
Pandit (1984)	$GR = DTR + IDTR + \mathbf{OCR}$ $DTR = f(YRNA)$ $IDTR = f(YRNA)$ $GS = DTR+IDTR+\mathbf{OCR}-GCNE-GOCE+\mathbf{CCNA}$	3	50–51 to 77–78
Pani (1984)	$GR = f(YN, \mathbf{GR_{-1}})$	1	69–70 to 81–82
CB (1987)	$GRR = f(YN, \mathbf{ETR, GRR_{-1}})$ $GKR = GMB + \mathbf{GNMB + FB}$ $GMB = f(D, \mathbf{GMB_{-1}})$	1	62–63 to 83–84
JS (1990)	$GR = TR + NTR$ $TR = f(YR, P, \mathbf{TR_{-1}})$ $NTR = f(YR, P, \mathbf{NTR_{-1}})$	3	70–71 to 87–88

Continued...

Statement – 4 (Concluded)
Government Revenue

Model	Specification	No. of Equations	Period of study
R A (1990)	$GR = f(\mathbf{GR_{-1}}, YN)$ **+** **+** $GCR = GMB + GNMB + \mathbf{FB}$ $GMB = \Delta GBBS + \mathbf{GBNB}$ **+** $\Delta GBBS = f(\Delta D)$ **+** $GBNB = f(YN)$ **+** $GNMB = f(YN)$	5	61-62 to 84-85

Statement – 5

Budget Deficit

Model	Specification	No. of Equations	Period of study
Sarma (1982)	BD = GE – GR	1	61–62 to 79–80
M N R (1982)	BD = GE – GR	1	51–52 to 79–80
K N (1984)	BD = GKE – **GPS - GB - FB**	1	61–62 to 79–80
Pandit (1984)	————		50–51 to 77–78
Pani (1984)	BD = GE – GR + + DB = f (HSS, D) B = **DB + FB**	3	69–70 to 81–82
C B (1987)	BD = GE – GR		62–63 to 83–84
JS (1990)	BD = GE – GR		70–71 to 87–88
R A (1990)	+ DT = f (BD) BD = GE – GR	2 1	61–62 to 84–85

Statement – 6

Price Movements

Model	Specification	No. of Equations	Period of study
Sarma (1982)	$P = f\ (\mathbf{YR}^{+}, \pi^{+}, (\mathbf{M/P})_{-1}^{-})$	1	61–62 to 79–80
M N R (1982)	———		51–52 to 79–80
K N (1984)	$PF = f\ (\mathbf{AF}^{+}, \mathbf{PPCY}^{-}, M/YR^{+}, \mathbf{WPF}^{+})$ $PR = f\ (\mathbf{PPCY}^{-}, M/YR^{+}, PIM^{+})$ $PM = f\ (PR^{+}, \mathbf{W}^{+}, PIM^{+}, M/YR^{+})$ $PE = f\ (\mathbf{WPI}_{-1}^{+} + PIM^{+})$ $WPI = f\ (PF^{+}, PR^{+}, PM^{+}, PE^{+})$ $CPI = f\ (\mathbf{WPI}_{-1}^{+}, \Delta WPI^{+})$	12	61–62 to 79–80
Pandit (1984)	$PF = f\ (\mathbf{M}_{-1}^{+}, \mathbf{AF}_{-1}^{-}, \mathbf{PF}_{-1}^{+})$ $PR = f\ (\mathbf{INF}^{-}, \mathbf{PMN}^{+}, \mathbf{YRM}_{-1}^{+}, M^{+})$ $PM = f\ (PR^{+}, PE^{+}, \mathbf{BCC}^{+}, (\mathbf{W\text{-}PY})^{+}, (IDTR\text{-}YRM)^{+})$ $PT = f\ (PR^{+}, PE^{+})$ $PF = f\ (INF^{+}, \mathbf{INF}_{-1}^{+})$ $WPI = PF + PR + PM + PT + PE + PMN$ $PG = (YRA/YR)\ \mathbf{IA} + (YRNA/YR)\ \mathbf{INA}$	17	50–51 to 77–78
Rani (1984)	$PF = f\ (M3/YR^{+}, YRM^{+}, \mathbf{SF}^{-}, YRA^{+}, YRNA^{+})$ $PR = f\ (PF^{+}, YRM^{+})$ $PM = f\ (PF^{+}, PR^{+}, PIM^{+})$ $WPI = f\ (M3/P^{+}, PF^{+}, PR^{+}, PAD^{+})$	5	69–70 to 81–82

Continued...

Statement – 6 (Concluded)
Price Movements

Model	Specification	No. of Equations	Period of study
CB (1987)	$P = f\ (M3^{+},\ \mathbf{P_{-1}}^{+},\ YR^{-},\ \mathbf{EIR}^{+})$	1	62–63 to 83–84
JS (1990)	$P = f\ (YR^{-},\ \pi^{+},\ (\mathbf{M/P})_{-1}^{+})$	1	70–71 to 87–88
RA (1990)	$P = f\ (M3^{+},\ YR^{-},\ \mathbf{P_{-1}}^{+})$	1	61–62 to 84–85

Statement – 7

Real Sector

Model	Specification	No. of Equations	Period of study
Sarma (1982)	Exogenous		61–62 to 79–80
M N R (1982)	Exogenous		51–52 to 79–80
K N (1984)	YR = YRA + YRI + YRF + YRT YRA = (YRA/**CA**)**CA**$_{-1}$ YRI = (YRI/**KI**)**KI**$_{-1}$ YRF = (YRF/**KF**)**KF**$_{-1}$ YRT = (YRT/**KT**)**KT**$_{-1}$	49	61–62 to 79–80
Pandit (1984)	YR = YRA + **YRM** + YRMF + YRT YRA = f (YRF, YRNF) YRT = f (YRA, **YRM**)	15	50–51 to 77–78
Pani (1984)	IA = f ((**IAF**/**AFI**), **WF**, **AFI**) INF = f ((**IAF**/ANFI), **WN**, **ANFI**, (**KAR**/**ANFI**)) YRM = f (KAR, ((GE–GCNE)/**PCF**), (GDER–GIE)) YRU = f (YRM, **KUR**) YRT = f ((YRA + YRM), **KTR**)	8	69–70 to 81–82
C B (1987)	YRT = f (KR, **GSA**, IMR) GKEF = f (**KGR, VDYR, FAR,** $\overline{\textbf{KPR}}$)	5	62–63 to 83–84
JS (1990)	ΔYR = f ($\Delta\hat{\text{YR}}$, **CUTL**) $\hat{\text{YR}}$ = f (DEVR, $\hat{\textbf{Y}}$**R**$_{-1}$) YR = f (**KR**$_{-1}$, (**M3/P**)$_{-1}$)	5	70–71 to 87–88
R A (1990)	KR = KGR + KPCR + **KPOR** ΔKGR = f (**GKE**) KPCR = f (KGR, **YR**$_{-1}$, **KPCR**$_{-1}$)	5	61–62 to 84–85

Statement – 8

External Sector

Model	Specification	No. of Equations	Period of study
Sarma (1982)	Exogenous		61–62 to 79–80
M N R (1982)	Exogenous		51–52 to 79–80
K N (1984)	Exogenous		61–62 to 79–80
Pandit (1984)	IMNF = f ((**GIE+KPCR**), INFM, PM, **RBFA**$_{-1}$) EX = f (**EXA**, PEXA) TB = EX – IM RBFA = **RBFA**$_{-1}$ + TB + **INV** + **FB** + **AID** – DS	8	50–51 to 77–78
Pani (1984)	EX = f (**WGDP**) IM = f (YND, PM/WPI) EXM = f (**WPI**$_{-1}$, WPI)	3	69–70 to 81–82
C B (1987)	IMR = f (YR, IMR$_{-1}$, EXRA$_{-1}$) EXR = f (**WY, EXRA**$_{-1}$)	3	62–63 to 83–84
JS (1990)	Exogenous		70–71 to 87–88
R A (1990)	Exogenous		61–62 to 84–85