

Development Research Group

Study

8

STABILISATION POLICY OPTIONS

A Macroeconometric Analysis

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Issued for Discussion

DRG Studies Series

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STABILISATION POLICY OPTIONS

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I. Objectives of the Study

The Indian economy is currently undergoing a stabilisation and structural adjustment programme to correct macroeconomic imbalances on the one hand and accelerate the overall growth rate of the economy on the other. As a part of the programme, the government has so far substantially deregulated private investment, import, and foreign capital inflow, divested a part of shareholding in public enterprises, reduced customs and excise duties, depreciated exchange rate of rupee, allowed the market to determine the exchange rate of rupee in respect of current account transactions and abolished export subsidy. The government has also announced its intention to deregulate remaining controls on imports, align custom duty rates to the international levels, privatise some public enterprises and close unviable and sick public enterprises, deregulate financial sector,

Dr. B.B. Bhattacharya, Professor, Institute of Economic Growth, Delhi, benefitted from discussions with Dr. C. Rangarajan, Governor and Dr. A. Vasudevan, Officer-in-Charge, Department of Economic Analysis and Policy, (DEAP), Reserve Bank of India. Dr. R.B.Barman is Director and Dr. A.K. Nag is Assistant Adviser in the Department of Statistical Analysis and Computer Services, RBI, Bombay. Dr.Himanshu Joshi, Assistant Adviser and Shri Ajay Prakash, Research Officer, DEAP were associated with the project in the early stages and the authors acknowledge with thanks the help received from them. The team was also helped by Sarvashri D. Anjaneyulu, D.K. Mohanty, R.K. Pattanaik, M.D. Patra and Balwant Singh, DEAP. The excellent stenographic and word processing assistance rendered by Shri A.B. Joshirao is also acknowledged with thanks.

particularly banking and insurance, curtail unwarranted subsidies, change labour laws, and introduce exit policy (Government of India :1993).

The successful implementation of the stabilisation and structural adjustment programme requires proper sequencing and co-ordination of various economic policies: fiscal, monetary, trade, exchange rate and other macro and micro policies. In economics, there is no unique theory, or model, of stabilisation. While there is a general agreement that stabilisation should precede rather than follow structural adjustment programme (Corbo, Fischer & Webb : 1992), in some cases it may be necessary to implement first structural adjustment before stabilisation (Williamson : 1992). During the eighties, about 50 countries have implemented stabilisation and structural adjustment programmes. As the decade progressed and the consequences of macroeconomic disequilibria became clearer, the development economists and practitioners increasingly accepted the view that broad macroeconomic stability is necessary for sustained growth (World Bank :1991).

In the decade of eighties the macroeconomists returned to growth theory. The new growth theory propounded by Romer (1986) and Lucas (1988) focuses on the adverse effects of government regulation on growth rate than on saving and investment rates as such. The new growth theory also reemphasises the importance of some classical propositions related to technology, human capital, economies of scale, international trade and long-run equilibrium. Levine & Renelt (1992) have critically reviewed empirical literature on the new growth theory based on cross-country results. It has been observed that while micro-economic factors do play a key role in growth, saving and investment continue to remain important determinants in practically all stages of development. Further, as Fischer (1993) demonstrates, macroeconomic stabilisation continues to be the pre-condition for any sustained acceleration of overall growth of the economy.

Different countries have tried different types of stabilisation programme, with or without IMF loans (which imposed certain conditionalities). The relative success and failure of these programmes are a subject matter of acute controversy. It has been observed that a programme which succeeded in one country has failed in another, even under almost similar conditions. Country experiences suggest that if a programme is implemented in the early stage of macroeconomic disequilibria then there is a greater chance of success. But once hyper-inflation sets in, as in many Latin American countries, it is difficult to correct macroeconomic imbalances, even if the structural adjustment programme is initiated with a 'big bang' (Kiguel & Liviatan : 1992). East Asian countries - Malaysia and Indonesia in particular - are classic examples where macroeconomic adjustment programme was initiated well before the crisis. These countries also initiated the programme on their own and consequently they had greater degree of freedom in designing the programme. In general, it has been observed that in a successful stabilisation programme, the growth rates of real GDP and exports increase quickly with a very short lag, but investment rate declines for a considerable period of time (Corbo & Fischer : 1992). The general conclusion that can be derived from country experiences is that the stabilisation programmes are not neutral: a given reduction in fiscal and external deficits can produce different macroeconomic as well as social costs (Bourguignon & Morrisson : 1992). Since each country has different macroeconomic conditions, it is not possible to adopt a standard programme for all the countries. The government should therefore design stabilisation and structural adjustment programme keeping in view not only the economic conditions in the country but also the political and institutional conditions necessary to implement it. The cost of an unsustainable stabilisation programme may be very high, because it can jeopardise the whole reform process (Williamson :1992). In this context, a macroeconometric evaluation of alternative programmes may be a useful exercise to shed light on the shape of changes that may take place in the economy under different policy options.

Another reason for which a stabilisation programme should be evaluated through a macroeconometric model is the possibility of a trade-off between different targets. A programme may satisfy one set of targets at the expense of the other. The GDP growth rate and inflation rate trade-off is a well-known example in the Keynesian model. Though this type of trade-off may be relatively more important for industrial than for developing countries, the possibility of such a trade-off for the latter cannot be ruled out. Both theoretical and empirical literature on inflation in developing countries suggest that there is a strong possibility of a trade-off between inflation and growth through structural disequilibrium in the growth process (Taylor : 1983). In India, a number of macroeconometric models have already established this (See the survey of literature on inflation in India : Bhattacharya & Lodh: 1990). There are other possibilities of trade-off between growth and employment, growth and trade balance, and growth and fiscal deficit. Finally, the dynamic impact of a stabilisation programme may be different from the static impact. A programme may have an initial adverse effect followed by a success later, or initial success followed by an adverse delayed reaction. It may be therefore necessary to evaluate quantitatively the impact of alternative stabilisation measures on various macroeconomic targets - real GDP growth rate, inflation rate, fiscal deficit rate, trade and balance of payments, etc. - in both short and medium run. Such an exercise would provide a useful guideline to the policy makers in choosing a sustainable programme of stabilisation.

This study aims to evaluate the current stabilisation programme in India through a macroeconometric model. The model built for this purpose incorporates all major stabilisation policy measures, and traces their effects on output, inflation, fiscal balance, foreign trade, balance of payments and domestic and external debt. The specification of the model is made keeping in view not only historical experience but also emerging scenarios from current liberalisation and globalisation programme in the Indian economy. The model is used to

evaluate the effects of stabilisation measures already undertaken in the last three years (1991-92 to 1993-94) and also to assess the emerging scenarios of the economy in the next three years (1994-95 to 1996-97) under alternative policy assumptions.

II. Stabilisation and Structural Adjustment Programme

Although stabilisation and structural adjustment are two distinct programmes, there is no clear cut distinction between the two in the economic literature. Before eighties the two programmes were generally tried independently of each other. In the eighties, many developing countries, as well as some industrial countries, notably, UK and New Zealand, have implemented a joint programme of stabilisation and structural adjustment. In such a case it is often difficult to distinguish between the effects of stabilisation and structural reform programmes. Even then it would be useful to distinguish between the effects of the two programmes.

The stabilisation programme can be implemented independently of the structural adjustment programme if the macroeconomic imbalances are transitory in nature. If an internal (say, monsoon failure) or external shock (disturbance in international trade or finance) temporarily destabilises the economy then a stabilisation programme can tackle the problem. However, if the imbalances are chronic then a structural adjustment programme would be necessary. Stabilisation measures would suffice when the basic structure of the economy requires no change. In general, when capacity utilisation can be improved without any structural change the stabilisation programme alone would succeed. On the other hand, if the capacity unutilisation is the result of chronic macroeconomic imbalances or when capacity utilisation itself cannot cure long-run problems of the economy, namely, slow growth in income and standard of living, a structural adjustment programme may be necessary, with or without stabilisation programme (Dornbusch : 1990).

In actual practice, however, it is not so easy to distinguish between the two effects. According to one view (Bourguignon & Morrisson:1992), stabilisation refers to measures concerning aggregate demand, while structural adjustment concerns aggregate supply. In this sense it is implied that the Keynesian aggregate demand problem is strictly a short-run phenomenon, and the long-run growth can be achieved only through a classical solution. In the World Bank studies (for instance : World Bank :1991, and Corbo, Fischer and Webb : 1992) stabilisation refers to short-term measures to correct macroeconomic imbalances and structural adjustment to measures relating to improvement of productivity through better allocation of resources. The Government of India's discussion paper on reforms (1993) endorses this view. Broadly, it classifies macro effects of reform as stabilisation and micro effects as structural adjustment. Both the World Bank and the Government of India, however, accept certain overlaps between the two effects and consequently there is no watertight distinction between effects of stabilisation and structural adjustment programmes in these studies.

Statistically, stabilisation and structural adjustment can be distinguished in terms of short and long-run fluctuations: corrections of fluctuations around trend line may be regarded as stabilisation and long-run shift in the curve as structural adjustment. It is implicitly assumed that in the short-run, productivity of both labour and capital is constant, and therefore investment multiplier is constant. Any change in productivity of - either or both - labour and capital would imply a structural reform in the growth process.

In this study, we shall define stabilisation as corrections of macroeconomic imbalances. Our primary concerns are growth of real output, inflation, fiscal deficit, investment rate, balance of trade, foreign exchange reserves, exchange rate and domestic and external debt. We shall, therefore, evaluate macroeconomic effects of monetary, fiscal, trade and exchange rate policies on the economy at the

aggregate level. The microeconomic effects of tax reform, privatisation, improvement in management of public sector, deregulation of private investment, foreign capital, exchange and labour markets, etc. will not feature in this study.

III. Macroeconomic Imbalances and Economic Crisis in India

In early 1990s, the Indian economy suffered from a very acute macroeconomic crisis, the like of which it never faced in the past. In June 1991 the official foreign exchange stock of RBI came down to about \$1 billion, which could sustain only two weeks' import requirements. For the first time in India's economic history the country was faced with the prospect of default on external debt servicing (Government of India :1993). The international credit rating of India was downgraded so much that fresh borrowing was not only difficult, but it also created a panic which led to a massive flight of capital out of the country, not only by NRIs but also by others through illegal capital transactions.

Throughout the 1980s the gross fiscal deficits of the Centre and States increased secularly and by 1990-91 the total gross fiscal deficit of the Centre and States became 10.0 per cent of GDP, of which the Centre's share was 8.4 per cent (see Table 1). The fiscal deficit not only stimulated aggregate demand very much above aggregate supply, but also led to an unsustainable debt servicing burden for the future. By the late-eighties the gross interest burden of the Centre as a proportion to Centre's tax revenue increased to 40 per cent, and the public debt (Centre and States together) - GDP ratio went up to almost 100 per cent (Bhattacharya & Guha : 1990).

Although the major portion of the public debt was domestic, the external debt also became very significant by the end of eighties. In terms of absolute magnitude India's external debt at US \$ 70 billion at the end of 1990-91 became the third largest among developing

countries, after Brazil and Argentina, (World Bank: 1993). External debt-GDP ratio climbed to 33 per cent, and external debt servicing as a ratio to exports of goods and services rose to 28 per cent. Although the external debt servicing ratio of India was still below that of many third world countries, it became a very serious problem because of the rising current account deficit, which became more than 3 per cent of GDP in 1990-91 (see Government of India [1993] Rangarajan Committee Report). The rising current account deficit and external debt servicing together led to a steady decline in foreign exchange reserves since 1985-86.

Despite a captive financial system at its disposal, the government borrowing from the RBI, or monetised deficit, went on rising and by late 1980s it crossed 3 per cent of GDP, which was excessive by any standard. The inflation rate (based on Wholesale Price Index) - on a point to point basis - climbed to 17 per cent per annum in mid-1991. This was on top of double-digit inflation rate in the previous year. The saving rate of the public sector fell drastically to only 1.7 per cent of GDP, while the saving of the general government was negative. Ironically, however, the structural retrogression in India happened along with a significant step up in the growth rate of real output from 3.5 per cent during the first three decades of development (1950-80) to 5.3 per cent during the eighties. But by the late-eighties it became obvious that such debt - both domestic and external - induced growth was not sustainable any more.

In the past macroeconomic crisis occurred in India mainly due to supply shocks (see Table 2). The economic crisis of mid-sixties owes its origin to two consecutive massive shortfalls in agricultural production - Bihar famine of 1965 and 1966 - and the two wars: Indo-China war of 1962 and Indo-Pak war of 1965. While the resultant inflation was subdued immediately after the bumper crop of 1967-68, the industrial recession continued for several years. The second major crisis occurred in the mid-seventies. This time, it was the result of

combined effects of monsoon failures of 1972 and 1974, and external shock of oil price hike (first energy crisis). The annual inflation rate climbed to more than 15 per cent in two consequent years during this crisis. But it immediately came down to almost zero after a very good harvest and a tight monetary policy (see Table 2). The third major crisis occurred in 1979; once again the result of bad weather and external shock of second oil price hike. In all these cases, the economy stabilised immediately after a good harvest. The macroeconomic stabilisation programmes pursued to control these crises generally relied mainly on control of aggregate demand, and consequently investment rate declined immediately after the crises.

In contrast to the earlier shocks, the crisis in 1990-91 did not happen due to any external shock (see Table 2). The foodgrains output in the previous three years (1988-91) was quite good. The Gulf crisis of 1990-91 might have aggravated the problem, but it cannot be regarded as the root cause of economic crisis in the 1990s (Bhattacharya:1992). An econometric exercise suggests that even without the Gulf crisis the Indian economy would have had a very serious foreign exchange problem in 1991-92 (Bhattacharya & Guha : 1992). All these suggest that the crisis of the nineties could not be tackled by a simple stabilisation programme. It required a combined stabilisation and structural adjustment programme.

The current stabilisation programme began with a big cut in real public investment. Although the original aim of the cut was directed more at government consumption than at investment, the effect was felt more on the latter in comparison to the former (see the Government of India, **Economic Survey**, 1992-93, and 1993-94 and the Reserve Bank of India, **Annual Report**, 1991-92 and 1992-93). Simultaneously, a tight squeeze was applied on money and bank credit to both public and private sectors. The combined effects of tight fiscal and monetary policies reduced not only public investment but also private investment. Real output fell partly because of a fall in

Table 1
Internal and External Deficit and Debt

Year	<u>Gross Fiscal Deficit</u>			Current Account Balance	Foreign Exchange Reserves (in billion dollars)	External Debt
	Centre	States	Total			
	(as percentage of GDP)					
1980-81	6.1	1.6	7.7	-1.2	5.9	—
1981-82	5.4	1.3	6.7	-1.5	3.6	—
1982-83	6.0	1.3	7.3	-1.3	4.3	—
1983-84	6.3	1.6	7.9	-1.1	5.1	—
1984-85	7.5	2.0	9.5	-1.2	5.5	—
1985-86	8.3	0.7	9.0	-2.3	6.0	—
1986-87	9.0	1.6	10.6	-2.0	5.9	—
1987-88	8.1	1.6	9.7	-1.9	5.6	—
1988-89	7.8	1.3	9.1	-2.7	4.2	57
1989-90	7.9	1.7	9.6	-2.3	3.4	64
1990-91	8.4	1.6	10.0	-3.3	2.2	70
1991-92	6.0	1.6	7.6	-0.9	5.6	74
1992-93	5.2	1.5	6.7	-2.1	6.4	79

Note: External debt includes borrowing for defence. It is based on new classification and not comparable to the data published in the earlier issues of RBI, **Report on Currency and Finance**, and the Government of India, **Economic Survey**.

Sources : The Government of India : **Economic Survey**, various issues and The Reserve Bank of India : **The Annual Report 1992-93**.

Table 2
Four Phases of Crisis and Recovery in the Indian Economy

Year	Real GDP growth rate(%)	Food Production (million tonnes)	Inflation rate(%)	Investment rate(%)	Foreign Exchange Reserves (billion dollars)
1964-65	7.6	78	9.4	15.1	0.25
1965-66	-3.7	63	8.5	16.8	0.38
1966-67	1.0	65	12.5	18.4	0.40
1967-68	8.1	83	9.6	15.4	0.47
1971-72	1.0	92	5.5	17.3	0.66
1972-73	-0.3	85	10.3	15.9	0.63
1973-74	4.6	92	17.8	19.1	0.74
1974-75	1.2	87	16.3	18.3	0.78
1975-76	9.0	106	2.9	18.8	1.66
1978-79	5.5	115	2.0	23.3	6.42
1979-80	-5.2	96	14.4	22.1	6.32
1980-81	7.2	113	12.4	22.7	5.85
1981-82	6.1	117	10.9	22.6	3.58
1989-90	6.9	150	8.8	26.7	3.37
1990-91	4.9	154	10.5	27.4	2.24
1991-92	1.1	146	14.8	24.2	5.63
1992-93	4.0	157	9.8	24.5	6.43

Notes :

- 1) GDP is GDP at factor cost.
- 2) Food production is net of seeds.
- 3) Inflation rate is measured from the implicit deflator for GDP at factor cost.

Source : The Government of India, Economic Survey 1993-94

investment rate and partly because of a squeeze on imports. The stabilisation policy, however, succeeded in lowering the inflation rate to a single digit and brought down the current account deficit to a more manageable level.

Although the controls were relaxed in the next two years, the squeeze on public expenditure continued to depress the real investment rate in public and private sectors. The real output growth rate improved partially in 1992-93 and 1993-94, but the average growth rate for the three years after the reform - at about 3 per cent per annum - was well below the trend growth rate of the eighties, 5.3 per cent. The most dramatic improvement took place in the case of foreign exchange; the stock of foreign exchange reserves, including gold stock held by the RBI, increased to as much as \$ 14 billion, from \$ 5.8 billion at the end of 1990-91. Equally impressive was the stability of the exchange rate of rupee after the current account convertibility, at around Rs. 31.6 per US dollar.

The fiscal deficit of the Centre decreased sharply in 1991-92. In the subsequent years, however, the decline was not very significant. In fact in 1993-94 there is a perceptible deterioration. Since the structural reform has not yet made any effect on the States' budgets, nor on the functioning of the public enterprises - whether State or Central - the overall fiscal deficit of the public sector did not come down much after the stabilisation programme. Similarly, the monetary policy after an initial tightening became more relaxed in the subsequent years. The inflation rate which initially decreased sharply after the commencement of the stabilisation programme did not decline much thereafter in spite of a very favourable monsoon and comfortable foreign exchange reserves position. We shall now evaluate this stabilisation programme through a macroeconomic model.

IV. A Stabilisation Policy Model for India

Basic Features of the Model

The model has four blocks of equations : output and investment; money and prices; government revenue and expenditure; and external trade, debt and balance of payments. To minimise equations in the system we have assumed a homogeneous production behaviour. This is, however, not very realistic because in India the behaviours of agricultural and non-agricultural sectors differ with respect to stabilisation policy. Agricultural output is essentially supply constrained. On the other hand, non-agricultural output has by now become considerably sensitive to aggregate demand (Chakravarty: 1979). Recent macroeconometric models for India have found empirical evidence in favour of this hypothesis, see, for instance, Bhattacharya (1984), and Krishnamurty & Pandit (1985). Surveys of recent macroeconometric models in India by Bhattacharya (1993) and Krishna, Krishnamurty, Pandit & Sharma (1991) also confirmed this. Secondly, the investment behaviour differs between agricultural and non-agricultural sectors. Public investment in agriculture promotes private investment in agriculture. In non-agricultural sector, however, public investment 'crowds out' private investment, at least in the short-run (Bhattacharya & Rao: 1986 and Krishnamurty : 1985). Thus, a fall in public investment may have a differential effect on the behaviour of output and investment in the two sectors. Further, the behaviour of price also differs between agricultural and non-agricultural sectors. Agricultural prices are more sensitive to agricultural supply, whereas non-agricultural prices, particularly of manufacturing goods, are influenced more by cost-push factors than by pure supply and demand conditions. If we consider all these factors then there is a strong case to dis-aggregate the economy into at least two sectors: agricultural and non-agricultural. In this analysis, however, we have restricted ourselves to the behaviour of the economy at the aggregate level for two reasons: first, to restrict the

number of equations in the system, and secondly, to analyse the stabilisation effect at the aggregate level without introducing structural disequilibria at the sectoral level. However, a disaggregated model along this line can also be built to evaluate the current stabilisation programme.

The model used for econometric analysis is an eclectic version of both classical and Keynesian models of income determination. Although it has a strong monetarist bias in price determination, it is not a pure monetarist model, like, Rangarajan & Arif (1990), in that it incorporates aggregate demand effect on output. Our overall framework is also not based on an IMF model for structural adjustment (Khan & Knight : 1981). It is also different from the modified version of IMF stabilisation policy model for developing countries, like Mansur (1989) or its Indian version, Mohanty & Joshi (1993), in that our model distinguishes between differential effects of government consumption and investment expenditure on output. In another aspect our model differs from the IMF type structural model in that we do not directly link fiscal deficit to current account deficit. There is, however, an indirect link through output and price.

As mentioned before, the model is designed explicitly to evaluate the effects of stabilisation policy measures in India. To the extent possible we have incorporated all relevant stabilisation policy instruments in our analysis. Inferences drawn from some of the recent macroeconomic models, such as Anjaneyulu (1993), Chakrabarty (1993), Singh (1993) and Jadhav & Singh (1990) are duly considered in the specification of the model. During the period of our analysis the economy was highly regulated, and consequently many of the key variables in the economy, such as interest rate, exchange rate and private investment, were determined more by administered policy than by the market mechanism. As a result, some of the policy instruments, particularly of the monetary policy, which were very highly regulated, turned out to be econometrically not significant at

the conventional degree of confidence, 95 or 99 per cent. However, considering their importance in the post-liberalisation period we have retained them in the model. The medium-term post-liberalisation policy scenarios are built keeping in view the recommendations of the Government of India (1993), Rangarajan Committee Report (Government of India : 1993) and Rangarajan (1994).

The model presented below consists of 40 equations, of which 15 are stochastic and the remaining 25 are identities. The parameters of the model are estimated using the annual time series data for the fiscal years 1970-71 through 1990-91. Data for this study are taken from published sources. In some cases we have made modifications on published data and redefined variables to suit the purpose of our analysis. Details of data sources and modifications are given in the Appendix. Since the number of parameters in the model exceeds the number of observations the stochastic equations are estimated by ordinary least squares (OLS) technique. Wherever necessitated, the OLS estimates are corrected for serial correlation by Cochrane-Orcutt transformation. The choice of variables and functional forms of equations is made on the basis of both theoretical and statistical criteria. Needless to say, several alternative specifications were tried (not reported here for lack of space) to arrive at the best fit model. In some cases we have incorporated dummy variables to neutralise effects of outlier and irregular changes. Dummy variables are also introduced to incorporate effects of major policy changes during the period of analysis.

The Model

1. Real GDP

$$\begin{aligned} \ln XGDP = & 2.646 + 0.634 \ln K(-1) + 0.105 \ln RF + 0.10 \text{DTXG} \\ & (8.35) \quad (19.66) \quad (4.50) \quad (2.93) \\ & + 0.067 \ln XQ - 0.007 \text{D7988} * \ln XQ + 0.0135 \text{DT80} \\ & (2.20) \quad (-6.07) \quad (5.69) \\ & + 0.039 \text{DXGDP} \\ & (4.59) \end{aligned}$$

$$\bar{R}^2 = 0.998 \quad DW = 1.84 \quad \text{OLS}$$

where $\text{DTXG} = \ln XG - \text{TXG}$ and TXG is trend growth of XG , defined by the equation :

$$\begin{aligned} \ln XG = & 9.764 + 0.075 \text{TREND} \\ & (294.3) \quad (28.31) \end{aligned}$$

$$\bar{R}^2 = 0.976 \quad DW = 2.05 \quad \text{OLS}$$

2. Real Net Capital Stock

$$K = K(-1) + XIG + XIP - DK$$

3. Capital Consumption Allowance

$$DK = \text{DKT} * K(-1)$$

4. Real Gross Public Investment

$$XIG = IG * 100/PIG$$

5. Real Government Domestic Expenditure

$$XG = G * 100/P$$

6. Nominal Government Domestic Expenditure

$$G = \text{GID} + \text{GCO} + IG$$

7. **Real Gross Private Investment**

$$\begin{aligned} \text{XIP} = & 2025.7 + 0.226 \text{XGDP} + 0.478 \text{XIP}(-1) - 917.53 \text{RA} \\ & (0.61) \quad (5.51) \quad (5.55) \quad (-3.01) \\ & - 0.704 \text{XIG} + 3678.4 \text{DXIP} \\ & (-1.93) \quad (4.80) \end{aligned}$$

$$\bar{R}^2 = 0.970 \quad \text{Durbin's h Statistic} = 0.51 \quad \text{OLS}$$

8. **Wholesale Price**

$$\begin{aligned} \ln \text{PW} = & 3.175 + 0.360 \ln \text{M3} + 0.398 \ln \text{PW}(-1) + 0.090 \ln \text{PQ} \\ & (1.93) \quad (5.52) \quad (3.71) \quad (2.39) \\ & - 0.407 \ln \text{XGDP} + 0.108 \text{DPW} \\ & (-2.19) \quad (5.29) \end{aligned}$$

$$\bar{R}^2 = 0.997 \quad \text{Durbin's h Statistic} = 0.29 \quad \text{OLS}$$

9. **Money Supply**

$$\begin{aligned} \text{M3} = & -5579.2 + 3.137 \text{RM} - 76.98 \text{CRR} + 637.83 (\text{RA} - \text{RB}) \\ & (-3.23) \quad (59.32) \quad (-0.22) \quad (1.41) \\ & + 3931.6 \text{DRM} \\ & (6.82) \end{aligned}$$

$$\bar{R}^2 = 0.999 \quad \text{DW} = 2.05 \quad \text{OLS}$$

10. **Reserve Money (average during the year)**

$$\begin{aligned} \ln \text{RM} = & 0.024 + 0.988 \ln \text{RML} \\ & (0.303) \quad (124.22) \end{aligned}$$

$$\bar{R}^2 = 0.999 \quad \text{DW} = 1.89 \quad \text{OLS}$$

11. **Reserve Money (end-year)**

$$\text{RML} = \text{RCG} + \text{FER} - \text{NML}$$

12. **RBI Net Credit to Govt. (monetised debt, stock)**

$$\text{RCG} = \text{RCG}(-1) + \text{ZRCCG}$$

13. **RBI Net Foreign Exchange Reserves**

$$\text{FER} = \text{FER}(-1) + \text{CAB} + \text{DRE} * (\text{GGBE} - \text{RGED} + \text{PGBE} - \text{RPED}) / 10 + \text{FCNR} + \text{FRES}$$
14. **Commercial Bank Advance Rate (average)**

$$\begin{aligned} \ln \text{RA} = & 1.493 - 0.102 \ln \text{XBCP} + 0.945 \ln \text{RB} + 0.067 \ln \text{CRR} \\ & (5.01) \quad (-3.02) \quad (23.54) \quad (1.71) \\ & + 0.077 \text{DRA} \\ & (3.63) \\ \bar{R}^2 = & 0.986 \quad \text{DW} = 1.75 \quad \text{OLS} \end{aligned}$$
where $\text{XBCP} = \text{BCP} * 100 / \text{PW}$
15. **GDP Deflator**

$$\begin{aligned} \ln \text{P} = & 1.585 + 0.614 \ln \text{PW} + 0.023 \text{TREND} + 0.013 \text{DT80} \\ & (9.86) \quad (13.33) \quad (5.31) \quad (6.35) \\ \bar{R}^2 = & 0.999 \quad \text{DW} = 1.84 \quad \text{OLS} \end{aligned}$$
16. **Public Investment Deflator**

$$\begin{aligned} \ln \text{PIG} = & -0.657 + 1.184 \ln \text{PW} \\ & (-2.33) \quad (18.74) \\ \bar{R}^2 = & 0.946 \quad \text{DW} = 1.79 \quad \text{OLS} \end{aligned}$$
17. **Nominal Gross Public Investment (public sector budget constraint)**

$$\text{IG} = \text{TQ} + \text{TD} + \text{NTR} + \text{GFD} - \text{GID} - \text{GCO} - \text{GNL} - \text{DRE} * \text{IGED} / 10$$
18. **Gross Fiscal Deficit**

$$\text{GFD} = \text{ZRCG} + \text{ZGND} + \text{DRE} * (\text{GGBE} - \text{RGED}) / 10$$
19. **Govt. Current Expenditure (other than interest payments)**

$$\begin{aligned} \ln \text{GCO} = & -6.106 + 0.809 \ln \text{XGDP} + 1.445 \ln \text{P} - 0.075 \text{DFC} \\ & (-2.14) \quad (2.66) \quad (8.97) \quad (-1.98) \\ \bar{R}^2 = & 0.996 \quad \text{DW} = 1.64 \quad \text{OLS} \end{aligned}$$

20. Tax on Domestic Income and Goods

$$\ln TD = -5.293 + 0.781 \ln XGDP + 1.271 \ln P + 0.108 DTD$$

(-3.79)	(5.23)	(15.77)	(6.97)
$\bar{R}^2 = 0.998$		DW = 1.56	OLS

21. Import Duty

$$TQ = TQT * IMP$$

22. Real Govt. Domestic Non-Monetised Borrowing

$$\ln XZGND = -16.589 + 1.879 \ln XGDP + 1.609 \ln RFD + 0.146 DGND$$

(-9.95)	(9.99)	(4.64)	(5.12)
$\bar{R}^2 = 0.943$		DW = 2.43	AR(1)

23. Nominal Govt. Domestic Non-Monetised Borrowing

$$ZGND = XZGND * PW/100$$

24. Govt. Interest Payment on Domestic Debt

$$GID = GIDR * GDD(-1)$$

25. Govt. Domestic Debt

$$GDD = RCG + GND$$

26. Govt. Domestic Non-Monetised Debt

$$GND = GND(-1) + ZGND$$

27. Govt. Interest Payment on External Debt (million dollars)

$$IGED = IGER * GED(-1)$$

28. Govt. Repayment of External Debt (million dollars)

$$RGED = RPGR * GED(-1)$$

29. Govt. External Debt (million dollars)

$$GED = GED(-1) + GGBE - RGED$$

30. Current Account balance

$$CAB = EP - IMP - DRE * (IGED + IPED) / 10 + PVT + NINV$$

31. Nominal Exports

$$EP = DXE * DRE * PE / 100$$

32. Real Exports (in constant dollars)

$$\begin{aligned} \ln DXE = & 4.431 + 0.799 \ln WI - 0.435 \ln PW - 0.598 \ln PE \\ & (14.61) \quad (6.41) \quad \quad (-3.55) \quad \quad (-2.25) \\ & + 0.515 \ln DRE - 0.174 DDRE \\ & \quad (1.84) \quad \quad (-3.57) \\ \bar{R}^2 = & 0.938 \quad \quad DW = 1.74 \quad \quad OLS \end{aligned}$$

33. Real Imports (in constant dollars)

$$\begin{aligned} XQ = & 453.14 + 0.044 XGDP - 51.73 PQ + 100.54 PW \\ & (0.49) \quad (2.22) \quad \quad (-4.90) \quad \quad (3.85) \\ & + 0.235 FER(-1) - 3928.6 TQT + 0.010 D80S * XGDP \\ & (3.50) \quad \quad (-1.73) \quad \quad (2.28) \\ \bar{R}^2 = & 0.989 \quad \quad DW = 2.18 \quad \quad OLS \end{aligned}$$

or

$$\begin{aligned} \ln XQ = & -0.593 + 0.593 \ln XGDP - 0.659 \ln PQ + 1.114 \ln PW \\ & (-0.28) \quad (2.87) \quad \quad (-4.41) \quad \quad (4.20) \\ & + 0.074 \ln FER(-1) - 0.1908 \ln TQT + 0.009 D80S * \ln XGDP \\ & (4.54) \quad \quad (-1.71) \quad \quad (1.70) \\ \bar{R}^2 = & 0.989 \quad \quad DW = 2.27 \quad \quad OLS \end{aligned}$$

34. Exchange Rate (rupees per unit of US dollar)

$$\begin{aligned} DRE = & 1.772 - 0.0002 CAB(-1) - 0.000134 FER(-1) + 0.030 PW \\ & (2.62) \quad (-3.26) \quad \quad (-2.47) \quad \quad (2.48) \\ & + 0.606 DRE(-1) - 0.783 D80S \\ & (4.59) \quad \quad (-1.68) \\ \bar{R}^2 = & 0.988 \quad \quad Durbin's h \text{ Statistic} = -0.09 \quad \quad OLS \end{aligned}$$

35. **Nominal Imports**
 $IMP = XQ * PQ/100$
36. **Unit Value of Imports**
 $PQ = PF * DRE$
37. **Interest Payment on Private External Debt (million dollars)**
 $IPED = IPDR * PED(-1)$
38. **Repayment of Private External Debt (million dollars)**
 $RPED = RPDR * PED(-1)$
39. **Private External Debt (million dollars)**
 $PED = PED(-1) + PGBE - RPED$
40. **Foreign Currency Deposit (flows in rupees crore)**
 $FCNR = - 5250.1 - 115.974 LBR + 757.66 RFD + 0.318 FER(-1)$
(-5.44) (- 3.57) (7.17) (6.34)
- 857.61 DFNR
(-3.48)
 $\bar{R}^2 = 0.950$ $DW = 2.07$ OLS

List of Variables (in alphabetical order)

ENDOGENOUS

1. CAB : Current Account Balance, Rs. crore
2. DK : Depreciation of Real Net Capital Stock (1980-81 Prices), Rs. crore
3. DRE : Rupee/Dollar Exchange Rate
4. DXE : Real Dollar Exports, million constant US dollars
5. EP : Nominal Exports, Rs. crore
6. FCNR : Foreign Currency Deposit (flows), Rs. crore

7. FER : Net Foreign Exchange Assets of Reserve Bank of India, Rs. crore
8. G : Nominal Government Expenditure (total), Rs. crore
9. GCO : Government Current Expenditure, Other than Interest Payments, Rs. crore
10. GDD : Government Domestic Debt, Rs. crore
11. GED : Public Gross External Debt, million US dollars
12. GFD : Gross Fiscal Deficit, Rs. crore.
13. GID : Interest Payment on Government Domestic Debt, Rs. crore.
14. GND : Government Domestic Non-Monetised Debt, Rs. crore
15. IG : Nominal Public Investment, Rs. crore
16. IGED : Interest Payment on External Public Debt, million US dollars
17. IPED : Interest Payment on Private External Debt, million US dollars
18. IMP : Nominal Imports, Rs. crore
19. K : Real Net Capital Stock, Rs. crore
20. M1 : Narrow Money Stock (average of monthly figures), Rs. crore
21. P : GDP Deflator (1980-81=100)
22. PED : Private External Debt, million US dollars
23. PIG : Public Investment Deflator (1980-81=100)
24. PW : Wholesale Price Index (1981-82=100)
25. PQ : Unit Value Index of Imports (1978-79=100)
26. RA : Commercial Bank Advance Rate (average), per cent
27. RCG : Net Reserve Bank Credit to Government (As on 31st March), Rs. crore
28. RGED : Repayment of External Public Debt, million US dollars
29. RM : Reserve Money (average of monthly figures), Rs. crore
30. RML : Reserve Money as on 31st March, Rs. crore

31. RPED : Repayment of External Private Debt, million US dollars
32. TD : Taxes on Domestic Income and Goods, Rs. crore
33. TQ : Import Duty, Rs. crore
34. XG : Real Government Expenditure (total), Rs. crore
35. XGDP : Real GDP at factor cost (1980-81 Prices), Rs. crore
36. XIG : Real Public Investment, Rs. crore
37. XIP : Real Private Investment, Rs. crore
38. XQ : Real Imports, Rs. crore
39. XZGND : Real Government Domestic Non-Monetised borrowing, Rs. crore
40. ZGND : Nominal Government Domestic Non-Monetised Borrowing, Rs. crore

EXOGENOUS

1. BCP : Commercial Bank Credit , Rs. crore
2. CRR : Cash Reserve Ratio, per cent
3. DGND : Dummy Variable for irregular changes in ZGND
4. DFC : Dummy Variable for years following a double-digit inflation Rate, 1 for 1974-75, 1975-76, 1980-81 and 1981-82 and 0 for other years
5. DDRE : Dummy Variable for more flexible exchange rate, 1 for 1985-86 to 1990-91 and 0 for other years
6. DKT : Depreciation Rate of net capital stock
7. DPW : Dummy Variable for irregular changes in wholesale price index, 1 for 1974-75, -1 for 1978-79 and 0 for other years
8. DRA : Dummy Variable for irregular change in RA, 1 for 1980-81 and 0 for other years
9. DRM : Dummy Variable for irregular changes in money supply in response to reserve money, 1 for 1982-83 to 1986- 87 and 0 for other years

10. DTD : Dummy Variable for tax collection efficiency, 1 for 1975-76,1976-77, 1978-79 and 1979-80, -1 for 1973-74 and 0 for other years
11. DT80 : Trend for the eighties, 1980-81 = 1....1990-91 = 11
12. DXGDP : Dummy Variable for irregular changes in real GDP, 1 for 1988-89, -1 for 1990-91 and 0 for other years
13. DXIP : Dummy Variable for irregular changes in real private investment
14. D7988 : Dummy Variable for more liberal import policy, 1 for 1979-80 to 1988-89 and 0 for other years
15. D80S : Dummy Variable for 80s, 1 for 1980-81 to 1990-91 and 0 for 1970-71 to 1979-80
16. FCNR : Foreign Currency Deposits, net inflow, Rs. crore
17. FRES : Residual Changes in Foreign Exchange Stock, Rs. crore
18. GGBE : Public Gross External Borrowing , million US dollars
19. GIDR : Average Interest Rate (%) on Government domestic debt
20. GNL : Government Net Lending, Rs. crore
21. IGER : Average Interest Rate (%) on External Public Debt
22. IPDR : Average Interest Rate (%) on External Private Debt
23. LBR : London Inter-Bank Offer Rate (%) for 6 months
24. NTR : Government Non-tax Current Revenue, Rs. crore
25. NML : Residual Sources in Reserve Money, Rs. crore
26. NINV : Net Invisibles in Current Account, Rs. crore
27. PE : Unit Value Index of Exports, 1978-79=100
28. PF : Index of Foreign Prices(PE / DRE)
29. PGBE : Private Gross External Borrowing, million US dollars
30. PVT : Private Transfers (net) in Current Account, Rs.crore
31. RA : Commercial Bank Advance Rate (weighted average), per cent
32. RB : Bank Rate, percent
33. RF : Rainfall Index

34. RFD : Interest rate (%) on 1-2 years Bank Deposit
 35. RPGR : Average Repayment Rate of External Public Debt, per cent
 36. RPDR : Average Repayment Rate of External Private Debt, per cent
 37. TREND : Time Trend, 1970-71 = 1... 1990-91 = 21
 38. TQT : Import Duty Rate
 39. WI : World Import, billion US dollars
 40. ZRCG : Net RBI Credit to Government (flow), Rs.crore

Notes :

- 1) Figures in parenthesis are t ratios.
- 2) \bar{R}^2 is coefficient of multiple determination, adjusted for degrees of freedom.
- 3) DW is Durbin-Watson statistics, replaced by Durbin's h statistic wherever applicable.
- 4) OLS stands for estimates by ordinary least squares.
- 5) AR(1) stands for estimates by first order Cochrane - Orcutt autoregressive transformations.

Description of the Model and Behaviour of Output and Investment

Equations (1- 7) describe behaviours of output and investment. Real GDP (XGDP) is assumed to be essentially supply constrained, where the capacity of output is determined by the lagged real capital stock, $K(-1)$. Given the capacity, the utilisation may depend crucially on real imports, XQ. A squeeze on imports of capital and intermediate goods is expected to adversely affect real output. The capacity utilisation may also vary in relation to the level of aggregate demand, which is a stable function of real government expenditure, XG. We postulate that an above trend line growth of real government expenditure ($DTXG = \ln XG$ minus the trend growth of XG, TXG) would stimulate aggregate demand and thereby increase capacity

utilisation of output, and a below trend growth of XG would decrease real GDP. Since the agricultural output, which constitutes a sizeable proportion of total output, fluctuates in relation to rainfall, we have used rainfall index (RF) as an additional variable in the output function. Preliminary results suggest that during the 80s there was a secular rise in real GDP - mainly in services income - which was unrelated to the growth of capital. We have, therefore, introduced a trend variable for '80s (DT80) in the production function, equation (1). The decade of '80s was also characterised by a significant rise in imports of consumer goods which had no production link. The response of output with respect to imports in this period, is therefore, reduced by a slope dummy D7988 (0 for 1970-71 to 1978-79 and 1 for 1979-80 to 1988-89). Finally, we observe that there was still an excess growth of XGDP in 1988-89 and a deficient growth in 1990-91 which are inexplicable by the variables above. A dummy variable (DXGDP) is, therefore, introduced for this purpose. All coefficients in equation (1) turn out to be statistically significant at 5 per cent level with proper signs. Two inferences may be drawn from the empirical behaviour of real GDP (equation 1) : first, the capacity utilisation of real output in the seventies and the eighties depended significantly on the aggregate demand generated by the government expenditure; and secondly, the elasticity of output with respect to capital is less than unity, which means that the incremental capital-output ratio is rising over time.

By definition, real net capital stock (K) is equal to the lagged capital stock, $K(-1)$, plus current real gross public (XIG) and private investments (XIP), minus real capital consumption allowance (DK), equation (2). We assume that DK is a fixed proportion (DKT) of K, equation (3). Equations (4 through 6) are definitional identities determining real gross public investment (XIG), government domestic expenditure (XG) and nominal government domestic expenditure (G), respectively.

Real gross private investment (XIP) is explained by a flexible

accelerator, where XIP depends on real income, XGDP, interest rate (RA; average interest rate on commercial bank advances) and lagged XIP. The private investment function also includes XIG as an explanatory variable to incorporate crowding out effect, if any. A dummy variable (DXIP) is added to neutralise measurement errors (which are very common in investment data) and irregular changes in investment behaviour due to many subjective factors. Results (equation 7) indicate that there is a significant discrepancy between the desired and the actual private investment behaviour. On an average, about half of investment decision is realised in a given year. This is very much understandable if we consider the fact that during the period of our analysis private investment was highly regulated by the government licensing policy. Equation 7 can also be interpreted as a Koyck-type lagged distributed function for private investment. The short and the long-run marginal propensities to invest turn out to be 0.23 and 0.33, respectively. XIP turns out to be highly sensitive to interest rate, with an elasticity of about -0.75. The crowding out effect is also significant. On an average, every one rupee increase in real public investment tends to crowd out real private investment by about 0.7 rupee, which means that only a part of the public investment can be replaced by private investment.

Money and Prices

The money and price block (equations 8 through 16) describes behaviours of money and price in a broad quantity theoretic framework. There are various measures of money. The two relevant measures in the Indian context are narrow money (M1), which is defined to include currency in circulation plus demand deposits of scheduled (commercial as well as co-operative) banks plus other deposits with the RBI, and broad money (M3), which includes not only demand but also time deposits of banks. From the point of view of pure liquidity behaviour, M1 is perhaps a superior measure of money supply in India. Our preliminary analysis also suggests that M1 is a

better predictor of price level than M3. The regulation of money supply however, concerns more about M3 than M1. The measurement of M1 is somewhat arbitrary, depending on the time to time rules and regulations regarding the proportion of the savings deposits to be considered as demand deposits by the RBI. Time deposits now constitute the major portion of bank deposits. Since the RBI credit policy is directed to the control of aggregate non-food credit, its effect is likely to fall on the aggregate monetary resources, i.e., M3. From the point of view of control of money supply, therefore, we should include M3 rather than M1 as the relevant measure of money supply. For an analytical description of monetary management in India, see Vasudevan (1991).

Wholesale Price Index (PW) is expressed as a simple dynamic function of current period money stock (M3), real GDP (XGDP) and lagged PW, (equation 8). In order to capture the effect of import price (including exchange rate) on domestic prices, we have included unit value index of imports (PQ) in price function. The abnormal rise (in 1974-75) and fall (in 1978-79) in Wholesale Price Index are neutralised by a dummy variable, DPW. The result shows that the elasticity of PW with respect to M3 is about 0.4 in the short run and about 0.6 in the long run, which is less than unity. Since M3 represents not only liquidity but also savings, the effect of excess growth of M3 (over XGDP), therefore, need not lead to proportional change in price level. The elasticity of PW with respect to XGDP turns out to be 0.4 in the short run and 0.65 in the long run. Every one per cent rise in import price tends to increase wholesale price by about 0.1 per cent, which is consistent with the direct evidence provided by the weight of imported items in Wholesale Price Index. One of the objectives of this study is to analyse the impact of various monetary policy instruments on money and bank credit. The money supply function (equation 9) assumes that the money multiplier ($\delta M3/\delta RM$) is not constant; it depends on the differential interest rates ($RA - RB$, where RA is average interest rate on commercial bank advances and RB is the bank

rate) and cash reserve ratio (CRR). The hypothesis is that if RA is higher than RB then commercial banks will have an incentive to increase bank advances by borrowing from the RBI and vice versa. On the other hand, if CRR is raised then the commercial banks will have less resources to create bank advances. Empirical results show that in equation 9 both (RA - RB) and CRR have proper signs but the coefficients are not statistically significant, particularly that of CRR. This is not entirely unexpected because after the bank nationalisation in 1969 the commercial banks in India did not operate fully under profit maximisation principle. Results showed that there was a structural break in the money multiplier behaviour during the period 1982-83 to 1986-87. This is incorporated by a dummy variable (DRM : 1 for 1982-83 to 1986-87 and 0 for other years).

For price behaviour, we have used average stock of money during the year; the corresponding reserve money stock is also average stock during the year. Equation (10) links average (RM) to year-end reserve money (RML). We consider three sources of changes in RML : net RBI credit to government, (RCG), which represents creation of reserve money on account of government budgetary operations, RBI foreign exchange stock (FER) and net non-monetary liabilities of RBI (NML, including sundry items not accounted in RCG and FER). RCG is equal to lagged RCG plus current monetised deficit (ZRCG). Changes in FER are decomposed into current account balance (CAB), net external borrowing - equal to, gross public (GGBE) and private external borrowing (PGBE) minus repayment of public (RGED) and private (RPED) external debt - net FCNR deposit (FCNR) and net foreign exchange reserves from all other sources (FRES), equation (13). The dollar values are converted into rupees by using the rupee-dollar exchange rate.

The monetary policy stance of R.B.I so far has been to set a target path of non-food credit, consistent with a likely growth in M3 which is largely determined by the growth in RM. In other words, the bank

credit to commercial sector is more supply constrained than demand constrained. Various credit control measures and broad sectoral credit targets set by the R.B.I also constrain banks' overall credit creation capacity. Given this policy environment, a revenue maximizing bank can possibly determine only the composition of its credit portfolio rather than its overall volume, subject to various policy targets. Thus although we have a regime of administered interest rates, the average realised interest rate on bank credit to commercial sector becomes endogenous as a result of complex interaction between the banks' portfolio choice behaviour and the volume of bank credit. The equation (14) explains RA in terms of real commercial bank credit, XBCP (nominal credit, BCP, deflated by PW), bank rate, RB, and cash reserve ratio, CRR. All coefficients in this equation turn out to be statistically significant with proper signs. RA for 1980-81 turns out to be an outlier. This is neutralised by a dummy variable, DRA (1 for 1980-81 and 0 for other years). The estimated elasticities of RA with respect to XBCP, RB and CRR are -0.1, 0.95 and 0.07, respectively. It appears that if the volume of bank credit is given and CRR is constant then RA will rise at more or less the same rate as RB.

Our model has two endogenous price variables other than PW. Implicit deflator for GDP (P) is expressed as a simple function of PW (representing commodity prices) and trend (TREND, representing secular increase in price of services), equation (15). The elasticity of P with respect to PW is 0.6 which is equal to the weight of commodity sector in national income. The residuals of this equation showed that there was a structural change in implicit deflator function in the eighties. This is represented by the dummy variable DT80. Implicit deflator for gross public investment (PIG) is regarded as a simple function of PW, equation (16). As expected, we find the elasticity of PIG with respect to PW greater than unity (1.18), which means that the prices of investment goods have risen faster than those of other goods.

Public Sector Revenue, Expenditure and Debt

The government budget constraint (equation 17) determines gross nominal public investment (IG). It is implied here that the ultimate burden of adjustment in government budget falls on IG rather than on net RBI credit to government (ZRCCG). In practice, perhaps, the government does an iterative balancing of IG in relation to ZRCCG. If the resource constraint is too tight then IG is curtailed. On the other hand if the demand for public investment can not be curtailed then the government prints money to balance the budget. Simulation experiments with both versions of the budget constraint equation (one determining IG with ZRCCG exogenous and the other determining ZRCCG with IG as exogenous) favour determination of IG rather than ZRCCG by the government budget constraint equation. This is further justified on the assumption that in the post-reform period the government is likely to operate the monetary policy independently of the fiscal policy. With this objective we have treated ZRCCG rather than IG as exogenous variable in our stabilisation policy model.

Current revenue is divided into three components : domestic tax receipts (TD), import duty (TQ) and non-tax current revenue (NTR). The last one includes internal resources of public sector undertakings for the plan. The current expenditure is divided into interest on government debt - domestic (GID) and external (IGED) - and other current expenditure (GCO). The budget identity incorporates effects of endogenous exchange rate (DRE) on public sector external borrowing (GGBE), repayment (RGED) and interest payment (IGED).

Gross fiscal deficit (GFD) is decomposed into three components: net credit from RBI (ZRCCG), net external borrowing (gross, GGBE, minus repayment of external debt, RGED), and net domestic non-monetised borrowing (ZGND). GGBE and RGED are converted into rupees by multiplying by rupee-dollar exchange rate (DRE). GGBE is treated as an exogenous variable in the model. The external borrowing

is, therefore, decided independently of the domestic resource gap. The rupee value of net external borrowing, however, depends on exchange rate, which is endogenous.

Gross fiscal deficit (GFD) in our model covers deficits of both Centre and States. Further, it includes government borrowing for investment in public enterprises. However, it excludes direct borrowing by public enterprises from domestic financial institutions. In essence, it is the public sector saving-investment gap, adjusted for government borrowing for non-investment capital outlay and direct borrowing by public enterprises.

The government current expenditure, other than interest payment (GCO), is related to real GDP (XGDP) and implicit deflator (P). The elasticity of GCO with respect to XGDP turns out to be less than unity (0.8), but greater than unity with respect to P (1.45), equation (19). The elasticity of domestic tax revenue (TD) with respect to XGDP is also less than unity (0.8) and with respect to P is more than unity (1.3), equation (20). Since the elasticity of GCO with respect to P is greater than that of TD, inflation is likely to widen the fiscal deficit. It has been observed that in the past the government has put a restraint on the growth of GCO immediately after hyper-inflation. A dummy variable (DFC, 1 for years following a double-digit inflation and 0 for other years) turns out to be significant. DFC is also used to incorporate tight budgetary policy in the post-reform years. Further, it has been observed that the efficiency of the tax collection system was relatively better during the mid-seventies. A dummy variable (DTD) incorporates the effects of this in the tax function.

Real government domestic non-monetised borrowing (XZGND, ZGND deflated by PW) is related to XGDP and real interest rate on commercial bank fixed deposit (RFD). The year to year discretionary changes in ZGND are represented by a dummy variable, DGND. The parameters of this equation, however turn out to be very unstable,

which is not unexpected because ZGND consists of government borrowing from banks, financial institutions and households having differential behaviours with respect to income and interest rates. In the full model simulation, therefore, we have considered ZGND as an exogenous variable.

Equations (23 through 29) determine government domestic and external debt in terms of outstanding debt and net borrowing during the year. Interest and repayment rates of external borrowing are treated as exogenous in our system.

External Transactions

The external sector covers trade, balance of payments and external debt. Current account is disaggregated into trade flows - nominal exports (EXP), nominal imports (IMP) - interest payment on external public (IGED) and private debts (IPED), and private transfers (PVT), which includes NRI remittances (eq. 30). All other current account transactions are combined into a single variable, called net invisible (NINV). Behavioural functions for exports and imports are analysed in terms of constant dollar flows, DXE and XQ, respectively. The current and capital account transactions together determine changes in RBI's foreign exchange stock, equation(13).

Export is assumed to grow positively in relation to world income (WI) and exchange rate (DRE), and inversely in relation to domestic price (PW) and export price (PE). An examination of exchange rate behaviour shows that up to 1985-86 the exchange rate was regulated very tightly. From 1985-86 onwards the exchange rate is adjusted much more flexibly in relation to trade balances, and domestic inflation (Nag & Upadhaya :1994). A dummy variable (DDRE) is introduced to incorporate this change in exchange rate behaviour. Empirical estimates of the export function (eq. 32) show that India's export earnings have grown slower than world income. The elasticity

of real export earnings (DXE) with respect to world income (WI) is 0.8, and is significantly different from unity at 5 per cent level. The elasticities of DXE with respect to domestic price (PW) and export price (PE) are also well below unity, so also is the elasticity of DXE with respect to DRE. This is consistent with the general behaviour of export earnings of most developing countries having a relatively high share of primary goods in total export basket. On an average, a one per cent rise in export price, other factors remaining same, would decrease real exports (in US dollar) by about 0.6 per cent, which means that nominal rupee export earnings would increase by 0.4 per cent. Similarly, a one per cent fall in exchange rate (rupee depreciation) would increase dollar exports by 0.5 per cent and rupee exports by the same rate. In this respect, our result is neither export pessimistic nor over-optimistic with respect to exchange rate adjustment.

Real imports (XQ) has grown slower than real GDP (XGDP), equation (33). However as indicated before, the propensity to import has increased during 1980s. The slope dummy for 1980s is positive. It appears that the real import is highly elastic with respect to the domestic price (1.1). However, the elasticity of XQ with respect to import price (PQ, which incorporates exchange rate effect) is less than unity (0.7) but slightly more than that of DXE. During the period of our analysis imports were tightly controlled by import licensing, which in turn was influenced, among other factors, by the availability of foreign exchange. The coefficient of lagged FER is therefore highly significant in equation (33). As expected, the import duty rate (TQT, measured as the last period ratio of customs revenue to imports) has a negative effect on imports. Since both the linear and log-linear versions reveal similar behaviour we have used the linear version of the real import function in the full model simulation.

Although the exchange rate was fully regulated by the RBI till 1991, it is worth examining as to what extent the market forces have influenced the exchange rate adjustment by the RBI. Equation (35)

relates DRE to current account balance (CAB) and foreign exchange stock (FER). It is assumed that these factors affect DRE with one year lag. Further, we assume that DRE is adjusted in relation to domestic price (PW). Finally, lagged DRE is introduced to incorporate the discrepancy between the desired and the actual exchange rate. Our empirical results suggest that these factors have strongly influenced the RBI exchange rate policy. As expected in any regulatory system, there is a big discrepancy between the desired and the actual behaviour of the exchange rate. Results suggest that on an average about 60 per cent of the changes in DRE by the RBI can be attributed to trade and balance of payments factors. We also find that the behaviour of the exchange rate has changed significantly during the 1980s, as revealed by the dummy for 1980s (D80S).

In the capital account, we assume that the external borrowing, foreign direct investment, and other capital inflows including financial inflows, are exogenous to current domestic economic conditions. Further, we assume that the interest rates, as well as repayment rates on both public and private external debt are exogenously determined. The foreign currency deposits (FCNR) is found to be positively related to the domestic interest rate (RFD, used as a proxy for interest rate on foreign currency deposits) and inversely to LIBOR, equation (40). However, this equation is not very robust in terms of parameters, which is not unexpected because many subjective factors influence the flow of FCNR. In the full model simulation, therefore, we have regarded FCNR as an exogenous variable.

Conceptually, the changes in the foreign exchange reserves of the RBI should be equal to the current account balance (CAB), net external borrowing ($DRE^* (GGBE - RGED + PGBE - RPED)$) and net capital inflow from other sources. As regards the last item only FCNR has been prominent until 1990. Foreign direct and portfolio investments acquired importance only after the liberalisation of the external sector. Further, trade data do not cover all defence transactions. We, therefore

need a balancing item (FRES) in the foreign exchange identity, equation (13). In the post-liberalisation period simulation, we have used PVT and FRES to incorporate additional inflow of foreign capital in the current and the capital account, respectively. It may be noted that foreign direct investment augments not only foreign exchange reserves but also domestic investment. Since the impact of foreign capital on real investment and GDP before 1991 was insignificant, we have ignored this.

Overall Behaviour

The overall behaviour of the model depicted by the structural equations can be summarised as follows. Real output in India, though essentially supply constrained, is also sensitive to aggregate demand. A very tight monetary and fiscal squeeze would, therefore, affect not only general price level but also real output. There is, therefore, a strong possibility of a trade-off between inflation and growth. Real output is also dependent on imports, and consequently a very severe squeeze on imports may improve balance of trade at the expense of growth. General price level, apart from being sensitive to money supply and output, is also influenced by import price. Devaluation or depreciation of exchange rate will, therefore, have an inflationary implication.

The price elasticity of government current expenditure is more than government current revenue. Inflation, therefore, has a tendency to widen the fiscal gap, which in turn fuels further inflation. However, a very tight monetary policy would affect public investment adversely. A sharp fall in money supply and bank credit, unless properly targeted to reduction of unproductive expenditure, may reduce inflation rate at the cost of output and investment. Thus, a very tight demand management policy may stabilise the economy at the cost of output, and perhaps employment. Finally, both exports and imports are sensitive to price and exchange rate. The exchange rate

also affects debt servicing. The net effect of exchange rate on the balance of payment, therefore, need not always be positive.

It is worth noting here that the parameters of the model presented above are estimated using time-series data for the pre-liberalisation period. Many of these parameters may alter drastically in the post-liberalisation period.

Validation of the Model

Structural equations of the model are evaluated individually in terms of estimated t ratio, overall goodness of fit (measured by R^2), and DW statistics, or Durbin's h statistic, whichever is applicable. All equations are satisfactory in terms of overall goodness of fit (more than 90 per cent of variations explained in each stochastic equation), and with rare exceptions all t ratios are also statistically significant at 5 per cent level.

The overall efficacy of the model is evaluated through dynamic simulation for the period 1972-73 to 1990-91. Some non-parametric summary measures of forecast errors of all endogenous variables are given in Table 3. Since the model is non-linear, the full model solution is obtained by simulating the equations through Gauss-Sidel method using RATS software. For the period 1972-73 to 1990-91 the model has predicted all endogenous variables very satisfactorily. The average error is less than 2 per cent for all key variables. (We have not presented here summary statistics for other endogenous variables, some of which are determined by technical relations, the prediction errors for which are even smaller). The average absolute error is also typically less than 10 per cent for all variables, except CAB and FER. Since CAB and FER are determined residually in the system, the errors of all explanatory variables cumulatively inflate the errors of these variables. RMSE appears to be reasonable for all variables, but Theil's U statistics for XIG is greater than 1 indicating that the directions of

Table 3
 Summary Measures of Prediction Errors
 Key Endogenous Variables

Variable	Average Error(%)	Average Absolute Error (%)	RMSE	Theil's U Statistic
XGDP	-0.3	0.6	1024.6	0.13
PW	0.4	1.4	1.9	0.22
P	0.5	1.0	1.5	0.14
XIG	-0.5	8.8	1630.4	1.03
XIP	-0.8	7.4	1749.2	0.47
K	-0.1	0.3	1115.2	0.05
M3	0.5	2.8	3167.0	0.20
RM	0.2	2.6	989.9	0.19
GCO	-0.4	3.6	2180.9	0.33
TD	0.3	2.4	843.5	0.21
GFD	-0.1	0.5	157.3	0.03
CAB	-1.4	13.8	765.3	0.37
FER	1.6	12.4	548.0	0.48
DEP	-0.02	2.6	281.5	0.23
DIM	-0.3	3.0	479.5	0.26
DRE	-0.2	2.2	0.3	0.35

RMSE stands for root mean square error

change of real public investment is not properly captured by the model. This could be due to the determination of nominal public investment residually by the government budget constraint equation. For all other variables the Theil's U statistics are, however, very close to zero.

Graphs 1 through 12, presented serially at the end, show the plots of actual and simulated values of major endogenous variables : XGDP, PW, DRE, FER, GFD, CAB, M3, RM, DEP, DIMP, XIG and XIP. It may be seen that the model has almost perfectly tracked not only the growth path of real GDP but also its turning points. General price level is also predicted very accurately. Prediction of real private investment is reasonably satisfactory. However, the tracking of real public investment is not as close as desired. The turning points of investments are predicted more or less correctly. The model has almost perfectly predicted money supply and reserve money. In the case of exports and imports (in dollars), not only the levels but also the changes have been predicted very well. The exchange rate is predicted fairly accurately. Interestingly, even current account balance and foreign exchange stock (in dollars) which are highly volatile are also predicted correctly.

The decade of eighties is characterised by two special features, namely, acceleration in the growth scenario and partial liberalisation. Before forecasting for the nineties it may be, therefore, interesting to evaluate the performance of the model in predicting yearly behaviour of key variables during the eighties. Table 4 compares actual and predicted values of 10 lead indicators of stabilisation, namely, real GDP growth rate (GR), inflation rate (IR), aggregate real investment rate (INVR), gross fiscal deficit rate (GFDR), money supply growth rate (M3R), ratio of current account balance to GDP (CABR), rupee - dollar exchange rate (DRE), money multiplier (M3M), foreign exchange reserves in billion dollars (FERD) and external debt service ratio (EDSR).

Table 4
Comparison of Actual and Predicted Values of Lead Indicators of
Stabilisation, 1980-81 to 1990-91

Year	GR		IR		INVR		GFDR		EDSR	
	A	P	A	P	A	P	A	P	A	P
1980-81	7.2	7.6	18.3	17.5	25.2	25.4	8.8	8.8	16.5	16.2
1981-82	6.1	6.2	11.2	6.4	24.9	24.2	7.1	7.2	16.9	16.6
1982-83	3.1	3.7	4.9	6.9	22.8	23.6	12.2	12.3	21.0	21.7
1983-84	8.2	7.8	7.5	8.5	21.4	23.1	7.9	7.9	26.9	27.4
1984-85	3.8	3.1	6.5	9.7	20.6	22.3	9.9	9.8	28.6	28.2
1985-86	4.1	5.6	4.4	4.3	22.6	24.3	13.6	13.3	40.1	38.8
1986-87	4.3	4.2	5.8	5.7	21.6	23.2	14.5	14.3	53.4	52.2
1987-88	4.3	4.2	8.2	6.6	24.6	24.2	13.0	13.0	47.2	48.4
1988-89	10.9	10.7	7.4	6.1	26.4	25.3	11.2	11.3	43.4	43.7
1989-90	5.6	6.6	7.4	9.1	27.2	26.8	12.0	11.8	37.8	38.4
1990-91	5.1	3.5	10.2	9.4	27.7	27.7	12.5	12.7	38.4	37.0

Year	CABR		FERD		DRE		M3R		M3M	
	A	P	A	P	A	P	A	P	A	P
1980-81	-1.7	-1.6	6.1	6.1	7.9	8.0	16.5	19.9	3.0	3.0
1981-82	-1.9	-1.8	3.1	3.5	8.7	8.4	17.3	7.8	3.1	3.0
1982-83	-2.0	-2.1	1.8	1.9	9.5	9.2	14.3	16.2	3.1	3.2
1983-84	-1.8	-1.4	1.6	2.4	10.1	10.3	17.4	28.1	3.2	3.2
1984-85	-1.4	-1.9	2.6	2.2	11.4	11.0	18.2	16.2	3.2	3.2
1985-86	-2.5	-2.3	3.0	2.9	12.4	11.9	17.8	8.6	3.2	3.1
1986-87	-2.2	-2.0	3.7	3.9	12.6	12.8	16.9	19.1	3.2	3.1
1987-88	-2.1	-2.6	4.2	3.5	13.0	13.3	17.6	13.2	3.1	3.1
1988-89	-3.3	-3.3	4.5	3.9	13.9	14.5	17.2	18.5	3.1	3.1
1989-90	-2.8	-2.9	3.8	3.1	16.2	16.2	18.9	22.9	3.1	3.1
1990-91	-3.7	-3.4	4.6	5.0	17.5	17.8	16.6	15.8	3.1	3.1

where

- GR : real GDP growth rate (%)
 - IR : inflation rate (%), Wholesale Price Index
 - INVR : aggregate real investment rate, (% of real GDP)
 - GFDR : gross fiscal deficit rate (% of nominal GDP)
 - EDSR : external debt service as per cent of merchandise exports
 - CABR : current account balance as per cent of nominal GDP
 - FERD : foreign exchange reserve in billion dollar
 - DRE : rupee - dollar exchange rate
 - M3R : growth rate of money supply, M3, (%)
 - M3M : average money multiplier, M3/ reserve money
- A stands for actual and P for predicted values.

It may be seen from Table 4 that the model has tracked the actual growth rate of real GDP very accurately. The prediction of the inflation rate is also very accurate except for one or two years. The actual and the predicted real investment rates have converged practically for all years. The same is true for the gross fiscal deficit rate, and even better for money multiplier. There are some differences between the yearly figures of the actual and the predicted growth rates of money supply (M3) in the first-half of the eighties. However, the average of actual and predicted growth rates of M3 in the first-half of the eighties (1980-81 to 1985-86) are very close to each other : 16.9 per cent against 16.1 per cent per annum. After 1985-86, the actual and the predicted growth rates have come very close to each other.

So far as the external sector is concerned, the exchange rate has been predicted very well by the model despite the fact that the exchange rate regime was highly regulated during this period. The foreign exchange reserve was somewhat over-estimated in the last three years of the eighties. This is largely due to the error in predicting the current account balance. However, the model has picked up the changes in the external debt service ratio very well. It may be noted that the external debt statistics in this study are taken from the World Bank - World Debt Tables which are higher than the corresponding figures available from the publications of the Government of India. Further, the denominator used here is merchandise exports rather than exports of goods and services as conventionally used in measuring debt service ratio. Our figures may, therefore, appear to be little higher.

It may be said on the basis of the above evaluation that the model has picked up not only the levels but also the turning points of lead indicators of stabilisation in India. The overall performance of the model in terms of its predictive ability in the eighties reinforces its validity and robustness and provides a reasonable basis for undertaking forecasts for the future.

Analysis of Forecasts

The basic objective of building this macroeconomic model is to evaluate different stabilisation policy options pursued during the last few years. It is well known that forecasting beyond sample period through a macroeconomic model is extremely hazardous. It is even more difficult when the parameters of the model are likely to alter due to a change in the economic regime. Therefore, some amount of calibration is necessary to constrain the forecasted path of some key variables within a plausible range.

The stochastic errors of the model within the sample period are constrained to be averaged out to be zero by the compulsions of the OLS algorithm, and such averaging out of error components can not be expected in the beyond sample period forecast for a short period of three to five years. Therefore, the growth rates of key variables as obtained in the forecasted period should be considered only as indicative. Since the forecasts of individual growth rates may be subject to large errors, the efficacy of the model has to be judged by the plausibility of the overall scenarios projected by the model. Further, the model forecasts can be used to evaluate the internal consistency of alternative growth scenarios. However, since the algorithm used for full model solution of a non-linear system of equations allows a convergence error, which may sometime blow up error of the model beyond the tolerable limit of the economy, the forecasts may not be always realistic in the beyond sample period. Finally, there is no guarantee that a statistical convergence in a computer simulation is an equilibrium solution.

Beyond sample forecasts depend crucially on the choice of the base year. The reform process began in 1991-92. So technically we have to use 1990-91 as the base year for the evaluation of stabilisation policy measures in the subsequent years. However, 1990-91 was an abnormal year in two respects. First, the domestic production was

destabilised due to caste and communal violence in 1990-91. The political instability in 1990-91 also aggravated the macroeconomic imbalances. On the external front, India's trade and balance of payments, particularly NRI remittances, were adversely affected by the Gulf War. We have, therefore, synchronised model forecasts for 1990-91 to the actuals by adjusting the values of dummy variables for real GDP and investment functions. Similar adjustments were also necessary to reconcile new data series (available from 1990-91) on trade and balance of payments to the old series.

Apart from the problem of data reconciliation, there is another reason to introduce dummy variables in the trade functions. Prior to the liberalisation, imports were highly regulated on the basis of the availability of foreign exchange. After the introduction of - first partial and later full - convertibility of rupee in the current account, the market-determined exchange rate has become the main regulatory factor of both exports and imports. The availability of foreign exchange reserves now influences imports only indirectly via its impact on the exchange rate. The coefficient of FER(-1) in equation (33), therefore, tends to over-estimate real imports. A dummy is necessary to correct this. For a similar reason, we need a dummy to adjust the export function to the market-determined exchange rate.

The data base for 1991-92 onwards are incomplete in many respects. The national accounts data are quick and provisional estimate which are generally subject to substantial changes in the final estimates. The detailed balance of payments data are at present available only up to 1990-91. We have to therefore not only extrapolate many balance of payments items for the subsequent years but also speculate about some emerging factors, like, portfolio investment from abroad. It is also worth noting here that some key parameters of the model may have changed significantly after deregulation of the economy. The export and import price elasticities are most likely to change in the deregulated regime in comparison to the earlier

controlled regime. The monetary sector behaviour is also likely to undergo a significant change. All these have to be kept in view in analysing the forecasts of the model for the 1990s.

The beyond sample forecast is made in two stages. In the first, we forecasted for the period 1991-92 to 1993-94 for which we have some information on the economy. Based on these forecasts, we can make an assessment about the overall efficacy of the model in tracking the growth path of the economy after reform. Subsequently, we have made forecasts for the next three years, 1994-95 to 1996-97, for which we have no information except the avowed intention of the government.

Forecasts for 1991-92 to 1993-94

Table 5 presents alternative forecasts of nine key indicators of stabilisation, namely, real GDP growth rate (GR), inflation rate (IR, measured from Wholesale Price Index), money supply growth rate (M3R), broad money multiplier (MM), exchange rate (DRE), foreign exchange reserves in billion dollars (FERD), gross fiscal deficit rate (GFDR, as percentage of nominal GDP), gross aggregate real investment rate (INVR) and current account deficit rate (CABR) for the period 1990-91 to 1993-94.

In the base run simulation (S0) the model predicts an average annual real GDP growth rate of 2.7 per cent. The average annual growth rate of real GDP from CSO (provisional for 1991-92, quick for 1992-93 and advance for 1993-94) estimates for this period turns out to be 3.0 per cent. The base run forecast for the average inflation rate is very close to actual, 11.7 per cent against 11.3 per cent respectively. This has happened despite a small discrepancy between the actual and the forecasted growth rate of money supply. It appears that the money multiplier has changed on account of large-scale foreign capital inflows after liberalisation.

The forecast of RBI foreign exchange stock turns out to be quite accurate. The model has successfully predicted the turning points in both current account balance and overall balance of payments position. The model forecast for FERD at the end of 1993-94 is around \$13 billion, against which the actual is now expected to be about \$14-15 billion. The discrepancy between the forecast and actual values of FERD in 1993-94 is largely on account of unexpected inflow of foreign capital in the last quarter of 1993-94. However, the forecast of exchange rate is very accurate.

The rupee- dollar exchange rate is predicted to be 32.2 in 1993-94, which is almost same as actual (31.7) in March 1994. The model, however, over-estimates current account deficit for 1991-92 and under-estimates it for 1993-94.

The preliminary estimates of trade and balance of payments are subject to major revision in the final estimates. Even national accounts, particularly investment data, undergo major revision in the final estimates. In view of this, it may be difficult to arrive at any concrete judgement about the forecasting performance of the model for the post-reform period. The available information, however, gives a fair degree of credibility to the base run forecasts of the model.

It may be interesting to examine the efficacy of different stabilisation policy measures pursued during the last three years. Table 5 presents seven alternative counterfactual policy simulations (S1 through S7) for the period 1991-92 to 1993-94. To begin with, we have tested the resilience of the economy against monsoon failure. In this simulation (S1) the rainfall in 1992-93 and 1993-94 is assumed to be deficient by 10 per cent. Further, we assume that the government had to import foodgrains to maintain the domestic food supply at the desired level. All other policy variables are assumed to remain unchanged. Results suggest that real GDP growth rate would have declined on an average by about half a percentage point per annum

Table 5
Forecasting Performance of the Model, 1991-1993

	GR	IR	INVR	GFDR	CABR	FERD	M3R	MM	DRE
Year	Actual								
1990-91	4.9	10.3	27.7	12.5	-3.7	4.6	16.6	3.1	17.5
1991-92	1.1	13.7	23.3	12.1	-0.9	7.4	17.2	3.2	25.4
1992-93	4.0	9.7	26.1	12.5	-2.3	7.6	18.2	3.4	29.9
1993-94	3.8	10.4	-	11.8	-2.1	13.1	-	3.6	31.7
	Base Run Simulation (S0)								
1990-91	5.3	9.4	27.6	12.6	-3.0	5.7	18.1	3.1	17.8
1991-92	0.6	13.4	26.0	12.7	-1.2	7.9	24.6	3.4	25.8
1992-93	3.9	12.9	25.4	12.6	-2.4	8.0	9.2	3.4	28.5
1993-94	3.6	9.2	25.5	11.6	-0.4	13.4	15.3	3.1	32.2
	Structural Adjustment with Monsoon Failure (S1)								
1990-91	5.3	9.4	27.6	12.6	-3.0	5.7	18.1	3.1	17.8
1991-92	0.7	13.4	26.0	12.7	-1.2	7.9	24.6	3.4	25.8
1992-93	2.5	16.7	25.4	12.6	-3.9	4.9	1.3	3.4	28.8
1993-94	3.2	13.5	25.1	11.5	-0.7	9.6	16.6	3.1	35.8
	Structural Adjustment without Devaluation (S2)								
1990-91	5.3	9.4	27.6	12.6	-3.0	5.7	18.1	3.1	17.7
1991-92	1.9	5.0	26.2	12.3	-2.8	4.0	10.5	3.5	18.8
1992-93	2.6	9.9	25.6	12.7	-2.0	4.5	9.2	3.4	20.4
1993-94	4.1	5.2	25.9	11.8	-0.6	10.4	10.2	3.1	20.9

	GR	IR	INVR	GFDR	CABR	FERD	M3R	MM	DRE
Structural Adjustment without Devaluation and without Extra Foreign Capital Inflow (S3)									
Year									
1990-91	5.3	9.4	27.6	12.6	-3.0	5.7	18.1	3.1	17.8
1991-92	1.5	2.5	26.1	11.7	-3.8	0.5	3.1	3.5	18.7
1992-93	1.6	9.7	25.7	12.5	-2.4	0.5	8.2	3.5	22.0
1993-94	3.7	3.3	26.0	11.8	-1.2	3.1	4.8	3.1	23.1
Structural Adjustment with Devaluation Restricted to 10 per cent (S4)									
1990-91	5.3	9.4	27.6	12.6	-3.7	5.7	18.1	3.1	17.8
1991-92	1.2	9.3	26.1	12.5	-0.9	6.0	17.1	3.5	22.5
1992-93	3.1	11.9	25.4	12.7	-2.3	6.6	10.1	3.4	25.1
1993-94	3.9	7.3	25.6	11.7	-2.1	12.1	12.5	3.1	27.0
Structural Adjustment with Devaluation but without Extra Foreign Capital Inflow (S5)									
1990-91	5.3	9.4	27.6	12.6	-3.0	5.7	18.1	3.1	17.8
1991-92	0.2	10.0	25.9	11.9	-1.9	4.3	14.3	3.5	25.6
1992-93	2.7	13.0	25.4	12.3	-1.8	4.5	9.9	3.4	30.2
1993-94	3.5	8.4	25.5	11.3	-0.2	9.0	13.4	3.1	33.3
Structural Adjustment without Monetary Squeeze (S6)									
1990-91	5.3	9.4	27.6	12.6	-3.0	5.7	18.1	3.1	17.9
1991-92	1.5	16.5	27.5	14.6	-1.6	6.9	35.4	3.4	25.9
1992-93	4.2	18.1	26.5	14.6	-2.9	5.9	19.4	3.4	29.9
1993-94	3.4	14.1	26.3	12.8	-0.8	10.4	22.3	3.1	35.4
Structural Adjustment with Fiscal Profligacy (S7)									
1990-91	5.3	9.4	27.6	12.6	-3.0	5.7	18.1	3.1	17.8
1991-92	1.8	27.2	25.0	13.9	-2.8	4.1	27.8	3.4	26.5
1992-93	2.1	19.4	24.9	14.2	-2.5	4.4	24.0	3.4	33.4
1993-94	2.8	15.3	25.0	12.5	-1.3	8.0	20.6	3.1	38.5

Symbols are the same as in Table 4

as compared to the base run average. Consequently, the average inflation rate would have gone up by about 3 percentage points per annum. The acceleration of the inflation rate would have been still higher but for a decline in the growth of foreign exchange and money supply. The current account balance deteriorates due to the higher inflation rate. By the end of 1993-94 foreign exchange reserves decline by \$ 4 billion (as compared to the base run forecast) and the exchange rate goes up to Rs.36 per dollar (against Rs.32 in the base run). It appears that the economy still depends crucially on the vagaries of monsoon.

Devaluation was one of the most important measures of the stabilisation and the structural adjustment programme. In order to understand its independent contribution to the programme, we have run a simulation without devaluation. In this simulation, we assume that the government is able to undertake all other policy measures. Results of this simulation (S2 in Table 5) show that the growth rate of real GDP would have remained more or less same, but the inflation rate would have been lower by about 5 percentage points per annum. However, the foreign exchange stock would have gone down, though the exchange rate would have stabilised around Rs. 21 per dollar. This scenario assumes that the devaluation was not a necessary condition for attracting increased foreign capital inflow which is an unrealistic assumption. In the next simulation (S3), we remove this unrealistic assumption and test whether the economy would have been sustainable without devaluation in 1991 and corresponding extra foreign capital inflow. The first thing we note is that the stock of foreign exchange reserves would have dipped below \$1 billion, which could have resulted in a deeper crisis. Concomitant with the foreign exchange crisis, current account balance would have also deteriorated by about 1 per cent of GDP and the exchange rate would have increased by about Rs. 3 per dollar. Clearly the devaluation was, therefore, a necessary condition for the stabilisation and the structural adjustment programme.

The devaluation was done in June 1991 in two stages: in the first stage rupee was devalued against major foreign currencies by about ten per cent, and subsequently it was further devalued by another eight per cent. It may be worthwhile to examine whether a ten per cent devaluation would have been sufficient. In simulation S4 we forecast with only ten per cent devaluation of rupee against dollar, and assume that all other policy changes would have been feasible with this. The results show that although the current account balance and consequently the foreign exchange reserve would have declined marginally - \$1 billion in 1993-94 - the gain in terms of lower inflation and exchange rate would have more than neutralised the loss. Thus, it appears that the economy could have overcome the foreign exchange crisis with a lower rate of devaluation. However, it may be noted that the psychological impact of devaluation on the foreign investors and NRIs is not incorporated in our model.

Equally interesting may be to examine the sustainability of the stabilisation and structural adjustment programme with devaluation but without the additional foreign capital inflow in all forms. The simulation result (S5) shows that the average growth rate would have remained more or less unchanged with somewhat lower inflation rate. The foreign exchange stock would have declined much more sharply (in comparison to the base run forecast, S0) along with a further depreciation in the exchange rate. In conclusion, we may say that though the devaluation was absolutely necessary to stabilise the economy, the purpose could possibly be achieved by a lower rate of devaluation.

An essential part of the stabilisation programme was to correct the monetary and fiscal imbalances. The gross monetised and aggregate fiscal deficits in 1990-91 were 3.2 percent and 12.5 per cent of GDP, respectively, both of which were unsustainable in the long run. The growth of money and public expenditure were, therefore, very tightly controlled in 1991-92. As mentioned before, the immediate impact of

this was lower growth and higher inflation rate. This, however, helped in stabilising the economy in subsequent period. The impacts of these policies evaluated through counterfactual policy simulations are presented in S6 and S7 (Table 5), respectively. In S6, the forecasts for 1991-92 through 1993-94 are made by letting the monetised deficit rate, bank rate and the CRR remain at 1990-91 levels. As expected, the average inflation rate rises by about 5 percentage points per annum though the real GDP growth rate remains more or less same. The gross fiscal deficit rate and the money supply growth rate rise well above the tolerable levels. Further, the foreign exchange stock declines and exchange rate reaches to about Rs.35 per dollar by 1993-94. The situation would have been far worse had the fiscal profligacy of 1990-91 continued (see S7). In almost all respects, the scenario projected by S7 is worse than S6. Not only the inflation rate, fiscal deficit rate, money supply growth rate and foreign exchange stock would have deteriorated, but the real GDP growth rate would also have declined. The exchange rate would have sky-rocketed to almost Rs.40 per dollar by 1993-94. Obviously, the monetary laxity and fiscal profligacy of the eighties would have been unsustainable in the nineties.

Notwithstanding the limitations of macroeconometric models, some inferences may be drawn from this analysis. A major stabilisation and structural adjustment programme was necessary to tackle the economic problems in 1991. The most significant adjustment was required in the case of exchange rate and trade flows, but for which it would not have been possible to sustain the growth rate of output and investment in the economy. Although the depreciation of rupee has increased the inflation rate, the alternative of keeping the currency overvalued would have been worse. However, it seems that the stabilisation could have been achieved with somewhat lower rate of depreciation of the exchange rate of rupee.

It appears that the adjustment programme could have been better designed to prevent fall of public investment and real output growth

rate. Had the burden of fiscal adjustment fallen more on government consumption than on investment, then the inflation and the balance of payment objectives could have been achieved along with a higher real income growth, and perhaps employment.

Forecasts for 1994-95 to 1996-97

We may now turn our attention to the evaluation of the forecast for the next three years. Table 6 presents forecasts of lead stabilisation indicators for 1994-95 to 1996-97 under alternative assumptions. In addition to the nine indicators defined earlier, we also present in this table, five more indicators which are of crucial importance to the policy makers, namely, average growth rates in current dollar exports (DEPR) and current dollar imports (DIMPR), current account balance in billion dollars (DCAB), external debt-GDP ratio (EDR) and external debt service ratio (EDSR). The base run forecast (F0) is made on the assumption that the current pace of the stabilisation and structural adjustment programme would continue for the next three years. It has been assumed that the parameters of the model would remain unchanged for the base run forecast. The following broad assumptions are made for the base run forecast. No major internal or external shock is contemplated in the next three years. The average import duty rate would be brought down gradually to 20 per cent by 1996-97. The government would encourage foreign direct and portfolio investments, but would discourage FCNR deposits. Further, the flow of external gross borrowing would stabilise at 1991 level. The projection of exogenous variables in the external sector is made after considering Rangarajan (1994). The world income and foreign price would rise by the recent trend growth rate of 5 per cent per annum. The net RBI credit to government is fixed at 1.5 per cent of nominal GDP, and the government non-monetised domestic borrowing would continue to grow at 15 per cent per annum, as observed in the last few years. In the case of government non-tax revenue, however we assume a higher growth rate of 25 per cent per annum (against about 20 per

cent in the last few years) to account for increased revenue from privatisation and divestment of shares in public enterprises. It is further assumed that the RBI would gradually slide down bank rate and cash reserve ratio to 10 per cent by 1996-97. The average interest rates on both government and private external debt as well as the average rates of repayment of government and private external debt would go up, or stabilise, in the coming years. The data on exogenous variables for the forecast period are given in the Appendix on data sources.

We also present three other scenarios. In the first, we assume that the structural adjustment programme will change the basic behaviour of the economy. In particular, it would increase the productivity of capital (elasticity of output with respect to capital) by 0.25 per cent per year and the monetary and trade variables would become more sensitive to interest rate, exchange rate and prices (the relevant parameters are increased by 1, 3 and 5 per cent, respectively in 1994-95, 1995-96 and 1996-97). Results of this forecast are presented in F1. Alternatively we present a pessimistic scenario (F2) wherein the basic behaviour of the economy remains unchanged (as in F0) along with a weather induced supply shock (20 per cent shortfall in rainfall in both 1995-96 and 1996-97). In this scenario, we assume that the government will be able to sustain the shortfall in agricultural production in 1995-96, but in the next year it will have to import additional foodgrains to maintain the public distribution system. This scenario would therefore provide a measure of degree of resilience of the economy to withstand supply shock in the post-liberalisation period. Finally, we present forecast (F3) with strong deregulation effect in monetary and external sectors without any direct improvement in the productivity of capital. Further, we assume that the government is unable for political economy reasons, or otherwise, to impose a very tight control on government current expenditure in the coming years ($DFC=0$). In F3, the monetary and trade parameters with respect to interest rate, exchange rate and prices are increased by 2, 5, and 10 per cent in 1994-

95, 1995-96 and 1996-97, respectively. Since this is likely to happen only after further deregulation of monetary and external sectors, we assume an increased capital inflow corresponding to this. (FRES is raised by Rs.4000 crore per year beginning 1994-95). Results of the four scenarios - F0, F1, F2 and F3 - are presented in Table 6. For brevity of analysis, we shall present only average or terminal year rates, whichever are more appropriate.

The base run scenario (F0) shows that the economy has the potential of average real GDP growth rate (during the period 1994-95 to 1996-97) of 5.6 per cent per annum, which is more or less the same as the trend growth rate in the eighties. The low growth rate of real GDP in the first three years of nineties was, therefore, the result of destabilisation caused by the macroeconomic imbalances mentioned earlier. The average inflation rate at 9.6 per cent is, however, higher than the eighties. It appears that the economy has now moved to a higher price expectation path. This is also evident from the above normal inflation rate in the last few years in spite of normal or very good monsoon. The average gross fiscal deficit rate (GFDR) and the money supply growth rate are likely to decelerate in the coming years if the stabilisation and structural adjustment programme is implemented steadfastly. The real investment rate may go up as a result of growth rate acceleration, see Table 6.

The dollar export growth rate at 14.6 per cent is very close to the Eighth plan projection and Rangarajan (1992). The model forecasts a relatively higher growth rate of dollar imports in comparison to dollar exports. As a result, the average current account deficit in dollar turns out to be slightly more than \$ 4 billion. As a ratio to GDP the current account deficit at 1.5 per cent appears to be sustainable in terms of the recent trends in foreign capital inflow. Although the foreign exchange reserves of RBI is likely to rise to \$17.6 billion by the end of 1996-97 the exchange rate continues to depreciate slowly till then to reach 33.1 rupees per dollar. The depreciation will occur partly because of

Table 6

Forecasts for 1994-95 to 1996-97 under Alternative Assumptions
(Average for 1994-95 through 1996-97)

Stabilisation Indicators	Base Run Scenario (F0)	Structural Adjustment Effects (F1)	Effects of Monsoon Failure (F2)	Deregulation without Productivity Improvement (F3)
GR	5.6	8.3	4.7	5.4
IR	9.6	13.9	16.3	21.6
M3R	13.5	14.0	13.6	15.0
M3M	3.3	3.3	3.2	3.2
GFDR	10.8	10.1	10.8	10.0
INVR	27.0	26.9	26.8	26.5
CABR	-1.5	-1.5	-1.9	-1.7
DEPR	14.6	19.2	18.3	25.3
DIMPR	18.1	22.0	19.7	26.6
DCAB	-4.3	-4.5	-5.4	-5.2
FERD*	17.6	16.2	11.7	15.9
DRE*	33.1	34.8	39.7	38.9
EDR*	29.8	27.1	30.0	28.6
EDSR*	55.7	49.4	51.0	43.1

* stands for figure at the end of 1996-97 .

Symbols are the same as in Table 4. The new symbols are :

DEPR : Average growth rates of exports in current dollar

DIMP : Average growth rates of imports in current dollar

DCAB : Current account balance in dollar

EDR : External debt as per cent of GDP

EDS : External debt service ratio.

current account deficit and partly because of inflation. If the foreign capital inflow turns out to be less than warranted then the rate of depreciation would be much higher. On the other hand if the growth rate of real GDP continues to be sluggish, as it is at present, then the import demand will not rise and the exchange rate may not depreciate, or may even appreciate, if the foreign capital inflow increases.

The external debt-GDP ratio (EDR) is projected to come down to about 30 per cent by the end of 1996-97, from about 39 per cent at present (end of 1993-94). The fall is stipulated on account of constant flow of external gross borrowing in base run forecast (F0). We assume that the government will henceforth encourage more foreign investment - direct as well as portfolio - and discourage borrowing from abroad. The external debt service as a ratio to merchandise exports on the other hand is likely to remain constant at about 56 per cent because the increase in dollar exports would be neutralised by the rise in external debt service - both interest and repayment on past debt - in the coming years.

The structural adjustment programme, if implemented faithfully, should increase productivity of capital. Various deregulation measures, such as, decontrol of private investment (domestic as well as foreign), import and exchange rate should also affect the behaviour of the monetary and trade sectors. Since the effect of deregulation on the economy takes time and many of the complementary deregulation measures are not yet undertaken we have not assumed them in the base run scenario (F0). In F1 we assume that the government not only implements sincerely the stabilisation and structural adjustment programme but the economy also responds to these positively. The average real GDP growth rate accelerates to 8.3 per cent in F1, from 5.6 per cent in F0. Much of the improvement appears to be on account of increased productivity of capital. Other measures of deregulation generally affect output only in the longer run. But if productivity of

capital rises then the remaining problem can be substantially mitigated.

As postulated earlier, any improvement in real GDP growth rate is likely to increase the inflation rate. Table 6 shows that average inflation rate in F1 is 4 percentage points higher than F0. The trade-off between growth and inflation will therefore continue even after the structural adjustment. The trade-off may occur because any increase in aggregate supply will require concomitant rise in aggregate demand, which in turn will inflate the economy partially. Aggregate demand is a stable function of real government expenditure. A rise or fall in real government expenditure would, therefore, affect both real output and price level. However, once the economy reaches full capacity output any further increase in real government expenditure will generate only inflation without growth.

Another reason why inflation rate in F1 turns out to be higher than F0 is the increasing sensitivity of the economy to market forces. In the pre-liberalisation period, the exchange rate was highly regulated. After the exchange rate is decontrolled, the sensitivity of both exports and imports to the exchange rate must have increased (which is also assumed in F1). This in turn has strengthened the exchange rate - price nexus. The exchange rate depreciation in F1 (as compared to F0), therefore, increases the inflation rate. Currently, the global economy is suffering from a severe recession, and considering this we have projected import price to rise by a modest 5 per cent per annum. If the global recession ends then the import price may rise faster than 5 per cent per annum, particularly oil price which affects India vitally. In that case the actual inflation rate may turn out to be even higher than what is projected in F1.

As expected, the gross fiscal deficit rate declines in F1 as compared to F0 because of higher real GDP growth rate and inflation rate. However, aggregate real investment rate does not show any

perceptible change in F1 as compared to F0. But since investment responds to real GDP growth with a lag this scenario may change in the following years. Money multiplier remains remarkably constant in all years and simulations. The real stability of the money multiplier can be, however, tested only after the financial deregulation is over.

The growth rates of dollar exports and imports in F1 increase by about 4 and 4.5 percentage points respectively over F0. The current account deficit, both absolute (in dollar) and as a percentage of GDP remain more or less the same as in F0. But since the economy becomes more open in F1 (higher ratios of exports and imports to GDP) the benefit from trade is likely to be greater in F1 as compared to F0. There would be, however, a fall in foreign exchange reserves by about \$ 1.4 billion by 1996-97 in F1, (\$16.2 billion against \$17.6 billion in F0) and consequently the exchange rate may go up to Rs.34.8 per dollar (against Rs. 33.1 per dollar in F0). The debt-GDP ratio and debt service ratio, on the other hand may improve because of higher growth in real GDP and dollar exports. The overall balance of payments and external debt scenario projected by F1 is, therefore, better than that in F0.

If the rainfall turns deficient in 1995 and 1996, then the average growth rate of real output (GR) may fall to 4.7 per cent. The corresponding inflation rate may shoot up to 16.3 per cent. The actual inflation rate in this case may turn out to be still higher if the price expectation rises in a drought year, as usually happened in the past. Further, it may be difficult to restrict the growth of monetised deficit (the net RBI credit to government) in such a situation. For the same reason the government may have to exceed the target non-monetised borrowing assumed for this forecast. The gross fiscal deficit ratio in drought situation may, therefore, turn out to be higher than what is projected by F2.

The exchange rate shoots up to about Rs.40 per dollar in F2 because of the acceleration in the inflation rate and the fall in foreign

exchange reserves. The dollar export growth rate therefore rises in F2 as compared to F0. Despite this the current account deficit, both in absolute value and as a ratio to GDP, deteriorates. The foreign exchange reserves dip to \$ 11.7 billion in 1996-97, a fall of almost \$ 6 billion from the base forecast. The debt service ratio, however, declines due to the rise in dollar exports. This result should be interpreted with caution : in a drought year the exports growth rate may not be sustainable if the fall in agricultural production affects exportable surplus of primary goods.

The structural adjustment programme in India is not yet complete. Many vital measures are not yet undertaken. At present the pace of reforms is relatively faster in the external sector. The increased inflow of foreign capital has improved the prospect of full convertibility of rupee in the near future. The financial sector deregulation is also likely to be accelerated, which in turn may attract more foreign capital. Unfortunately, however, the productivity of domestic investment has not so far shown any positive response to these. The industrial growth rate is still well below the potential. The gross fiscal deficit rate has also not come down to the warranted level. F3 shows that if the productivity of domestic capital does not improve after the structural reform then not only the growth rate of real GDP would be below potential but the inflation rate would further accelerate beyond base scenario. Gross fiscal deficit rate of course comes down but it is mainly due to the higher inflation rate. The growth rates of both dollar exports and imports increase but since the latter has a higher base value the current account deteriorates. Despite increased foreign capital inflow the foreign exchange reserves decline by about \$ 2 billion, and the exchange rate touches almost Rs.40 per dollar by 1996-97. It is obvious that if rainfall fails along with these changes then the economy would be in further trouble.

The forecasts for the next three years (1994-95 to 1996-97) under alternative assumptions indicate that if the stabilisation and structural

reform programme announced by the Government of India (1993) is implemented faithfully then the growth rate of real GDP may accelerate, albeit at the cost of higher inflation. The improvement in the real GDP growth rate is conditional on the rise in productivity of capital. If however weather turns unfavourable then in spite of a rise in the productivity of capital the average growth rate of real output may decelerate and the inflation rate would accelerate further. There is no perceptible change in either aggregate real investment rate or gross fiscal deficit rate between optimistic and pessimistic scenarios.

The balance of payments and the external debt scenario appear to be reasonably sustainable in normal and optimistic growth scenarios. However the external sector will come under severe strain if the monsoon becomes very unfavourable in the next two years (1995-96 and 1996-97). The situation may become worse if the fall in foreign exchange reserves and the rise in inflation rate lead to hyper expectation of price and exchange rate depreciation. This in turn may adversely affect the foreign capital inflow. The growth of productivity of domestic capital is, therefore, a must to prevent such a situation. The success of the structural adjustment programme would depend crucially on this.

V. Summary and Conclusions

In this study, an attempt has been made to evaluate the on-going stabilisation programme in India through a macroeconomic model. The model is built keeping in view not only historical experience but also post-liberalisation situation. The model traces effects of various stabilisation policy instruments-fiscal, monetary, exchange rate, trade and balance of payments - on output, inflation, fiscal and trade balances, and domestic and external debt. The parameters of the model are then used to project growth paths of the economy in the short and the medium-run under alternative policy assumptions.

The empirical results indicate that the acceleration of real GDP growth rate during the eighties was caused, among other factors, by a stimulation of aggregate demand through fiscal deficit. A very tight fiscal and monetary squeeze, particularly cutting public investment would, therefore, result in a trade-off between inflation and growth, as happened in the early nineties. The simulation result however shows that the fiscal profligacy of the eighties could not have been sustained beyond a limit. An excessive fiscal deficit not only adversely affects inflation and current account balance, but also distorts future budgetary conditions through its dynamic effects. However, it would be worth noting that the fiscal profligacy as such would not have affected the real GDP growth rate. It becomes unsustainable in terms of high inflation and adverse balance of payments.

Since real output depends on imports, a very tight squeeze on imports may adversely affect real output growth rate. Further, since domestic price is positively related to import price, the devaluation may improve trade balance at the cost of higher inflation. Simulation results, however, suggest that an exchange rate adjustment was absolutely necessary to improve trade balance in the post-liberalisation period, though it appears that a lower rate of exchange rate depreciation could also have served the purpose. It is also observed that the devaluation itself could have stabilised the balance of payments position substantially. The recent excessive inflow of foreign portfolio capital was, therefore, not a must for stabilisation.

Our econometric exercise suggests that there are trade-offs between growth and inflation on the one hand and growth and balance of payments on the other. The analysis, however, indicates that the stabilisation programme has improved balance of payments and inflationary situation at the cost of lower growth of output. The real solution to the problem, therefore, lies in accelerating the growth rate through structural reforms.

An analysis of the forecasts from the model for the next three years (1994-95 to 1996-97) under alternative assumptions indicate that if the stabilisation and structural reform programme announced by the Government (1993) is implemented **faithfully** then the growth rate of real GDP would accelerate, though the inflation rate would also rise. The acceleration of real GDP would depend crucially on the improvement in the productivity of capital. If, however, the monsoon fails badly in 1995 and 1996, like in 1965 and 1966, then there would be a sharp fall in real GDP growth rate, and inflation rate will accelerate. The pressure on external sector - exchange rate and foreign exchange stock - in such a situation would depend crucially on price and exchange rate expectations. Thus, unless there is a significant improvement in the productivity of capital and fiscal balance, the economy could be once again destabilised by bad rainfall. The success of the on-going stabilisation programme in the next few years will, therefore, depend crucially on the weather conditions on the one hand, and on the improvement in fiscal balance and the productivity of capital on the other.

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Appendix

Data Sources and Modifications

The basic sources of data for this study are CSO: **National Accounts**; RBI: **Report on Currency and Finance and Annual Report**; and Government of India: **Economic Survey and Budget Papers**. Data on external debt and its components are taken from the World Bank: **World Debt Tables**. Data on world income and LIBOR are taken from IMF: **International Financial Statistics**.

Rainfall index is computed by RBI, Department of Statistical Analysis and Computer Services. Normal rainfall has been assumed as average of 21 years' rainfall. Aggregate national rainfall index is the weighted average of States' indices. States' indices in turn are weighted averages of crop-wise indices.

The government in this model refers to the general government (Centre, states, union territories together). The inter-governmental transactions are netted out to arrive at the governments' net debt and borrowing from other sources. The government non-tax current revenue includes public enterprises' internal resource mobilisation for plan financing. The fiscal deficit includes the government borrowing for investment in the public enterprises. It is measured as the sum of government domestic resource gap, as given in **Economic Survey**, plus public and public guaranteed gross external borrowing, as given in the **World Debt Tables**. The external debt, gross borrowing, repayment and interest payment in US dollars are converted into rupees by using the rupee - dollar exchange rate. The fiscal deficit measure in this study would, therefore, differ from the conventional measure.

All data up to 1992-93 are taken from published sources. Some balance of payments items for 1991-92 and 1992-93 are projected on the

basis of latest information on magnitude and growth rates of relevant variables. Figures for 1993-94 are mostly conjectured using latest information from RBI: Annual Report 1992-93 and Weekly and Monthly Bulletin, and the Government of India: Economic Survey 1993-94 and Union Budget 1994-95.

Data on exogenous variables for 1994-95 through 1996-97 are projected on the basis of certain assumptions. These assumptions are derived from the pronouncements of the Government and RBI and our own judgements about the economy in the coming years based on past data and future trends. GGBE and PGBE are assumed to be constant at the 1993-94 levels of \$10 and \$2 billion, respectively. NINV is assumed to be Rs.10,000, Rs.12,000 and Rs.14,000 crore in 1994-95, 1995-96 and 1996-97, respectively. PVT and FRES are assumed to be respectively Rs.14,000 and Rs.6,000 crore in 1994-95, Rs.15,000 and Rs.8,000 crore in 1995-96, and Rs.16,000 and Rs.10,000 crore in 1996-97. FCNR is frozen at Rs.2,000 crore. RPGR, IGER, GIDR, IPDR, RPDR are assumed to be as follows:

Year	RPGR	IGER	GIDR	IPDR	RPDR	TQT
1994-95	0.08	0.075	0.105	0.10	0.08	0.30
1995-96	0.085	0.08	0.11	0.10	0.08	0.25
1996-97	0.09	0.08	0.115	0.10	0.08	0.20

For other variables we assume the moderated trend growth rates (per cent per annum) as follows: PF, 5.0, WI, 5.0, ZGND, 15.0, and NTR, 25.0. PE is projected as $1.8 * PW$ and ZRCG is fixed at $0.015 * Y$ where Y is nominal GDP. Rainfall index in base forecast is assumed to be 100. In pessimistic scenario, RF is fixed at 80 for two consecutive years, 1995-96 and 1996-97.

The dummy variables for the base run forecasts are as follows: DM1 = 0; D7988 = 0 in 1991-92 (import control) and 1 for other years;

DT80 continues to increase from 11 in 1990-91 to 17 to 1996-97; DPW = 0; TREND continues to increase from 21 in 1990-91 to 27 in 1996-97; DXIP = 0; DFC = 0; DDRE = 1; DXGDP = -1; and D80s = 1

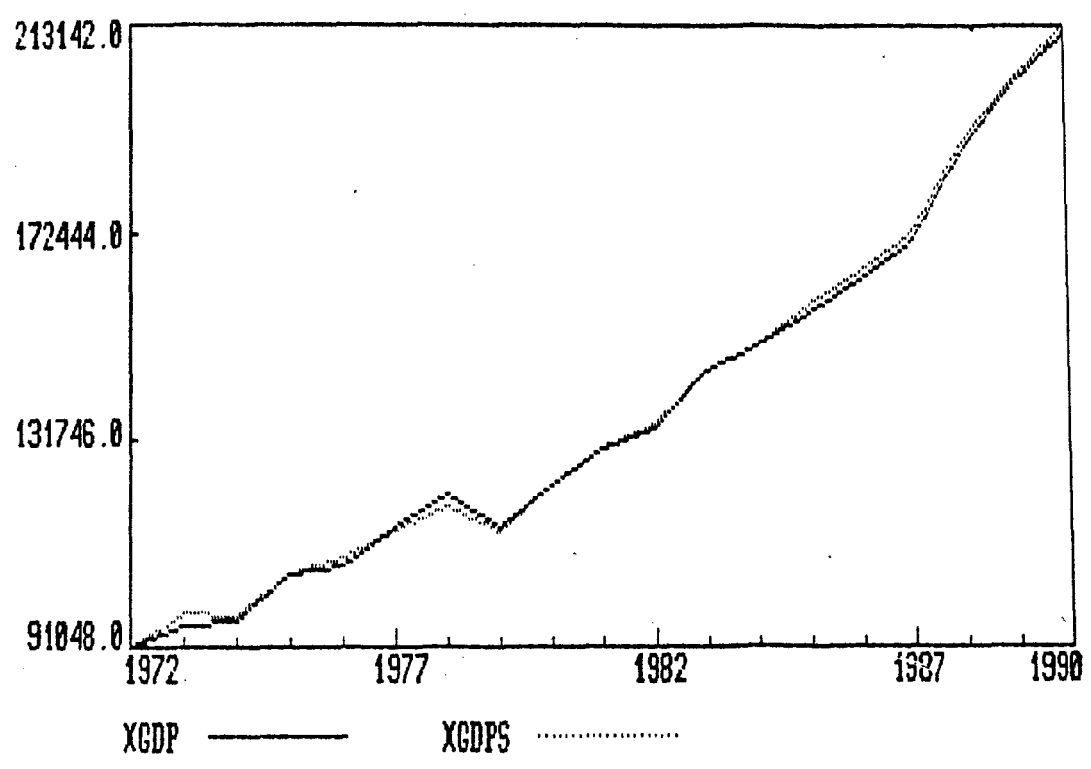
Additional dummy variables introduced to incorporate changes after 1991 : D91 (devaluation dummy, 6.5 from 1991-92 to 1996-97), DEXP, DIMP and DIG. The last three are dummies to adjust changes in data base after 1990-91.

Changes in simulations are as follows:

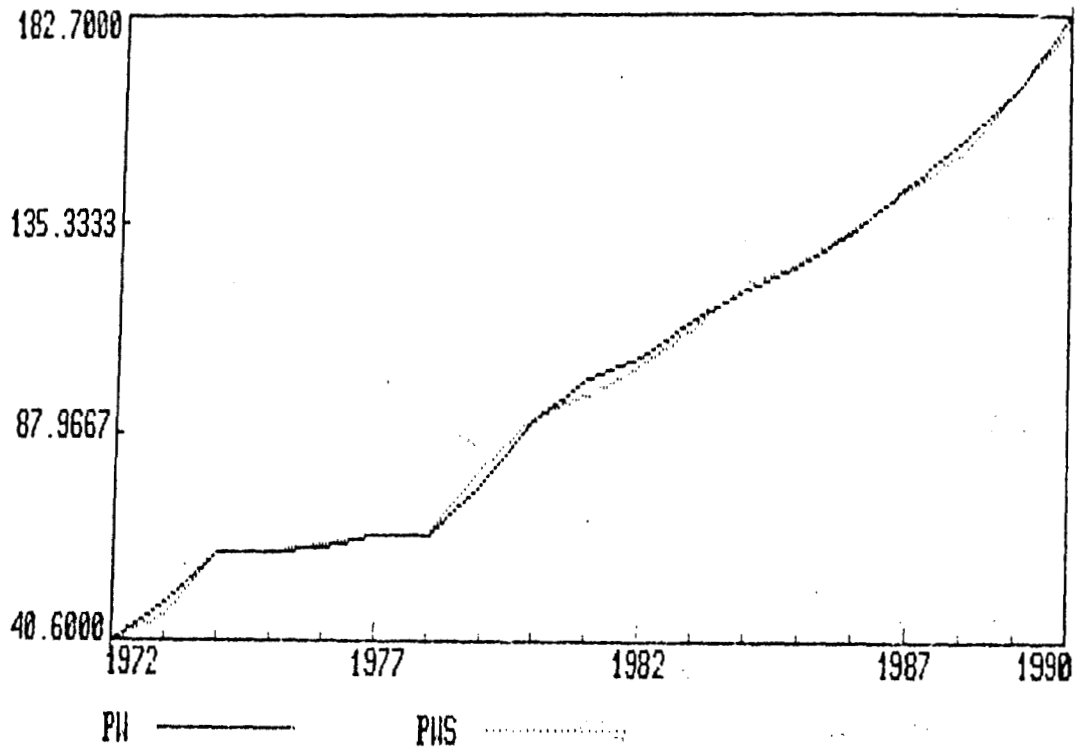
- S1 : Bad rainfall : RF = 90 in 1992-93 and 1993-94. DXQ = 0, DPW = 1 in 1992-93 and 1993-94.
- S2 : No devaluation : D91 = 0.
- S3 : No devaluation and no extra foreign capital inflow : D91 = 0, PVT and GGBE constant at 1989-90 level, NINV = 0.
- S4 : Only 10 per cent devaluation : D91 = 3.5.
- S5 : Devaluation without extra foreign capital inflow : PVT and GGBE constant at 1989-90 level, NINV = 0.
- S6 : Structural adjustment without monetary squeeze : ZRCG = 17250, 20700 and 24840 in 1991-92, 1992-93 and 1993-94, respectively; BCP = 197534, 237041 and 284449 in 1991-92, 1992-93 and 1993-94, respectively; DPW = 1; RB and CRR same as in 1990-91.
- S7 : Structural adjustment with fiscal profligacy : DFC = 0; GNL = 0; ZRCG and DPW same as in S6.

- F1 : Reform effects : coefficient of log XGDP with respect to log K(-1) increased by 0.25, 0.5 and 0.75 per cent in 1994-95, 1995-96 and 1996-97, respectively; coefficients of XIP, M3, XQ, DXE, RA and DRE with respect to RB, CRR, RA, PW, PQ and DRE are raised by 1, 3 and 5 per cent in 1994-95, 1995-96 and 1996-97, respectively.
- F2 : Bad rainfall effect : RF = 80 in 1995-96 and 1996-97; DPW = 1, 2 and 2 in 1993-94, 1995-96 and 1996-97, respectively; DXQ and ZRCG adjusted accordingly.
- F3 : Reform without productivity change:
DFC = 0, FRES raised by 4000 per year and coefficients of XIP, M3, XQ, DXE, RA and DRE with respect to RB, CRR, RA, PW, PQ, and DRE are raised by 2, 5 and 10 per cent in 1994-95, 1995-96 and 1996-97, respectively.

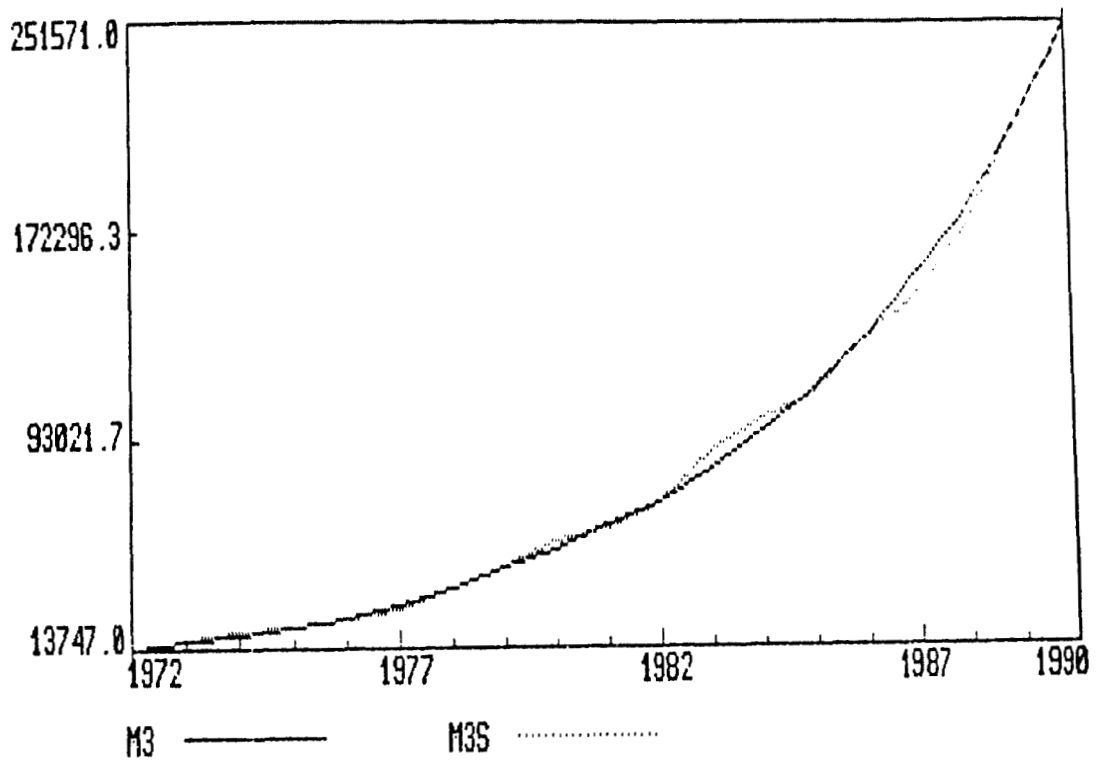
Graph 1:- Actual (XGDP) and Simulated (XGDPS) Values of Real GDP (Rs.crore)



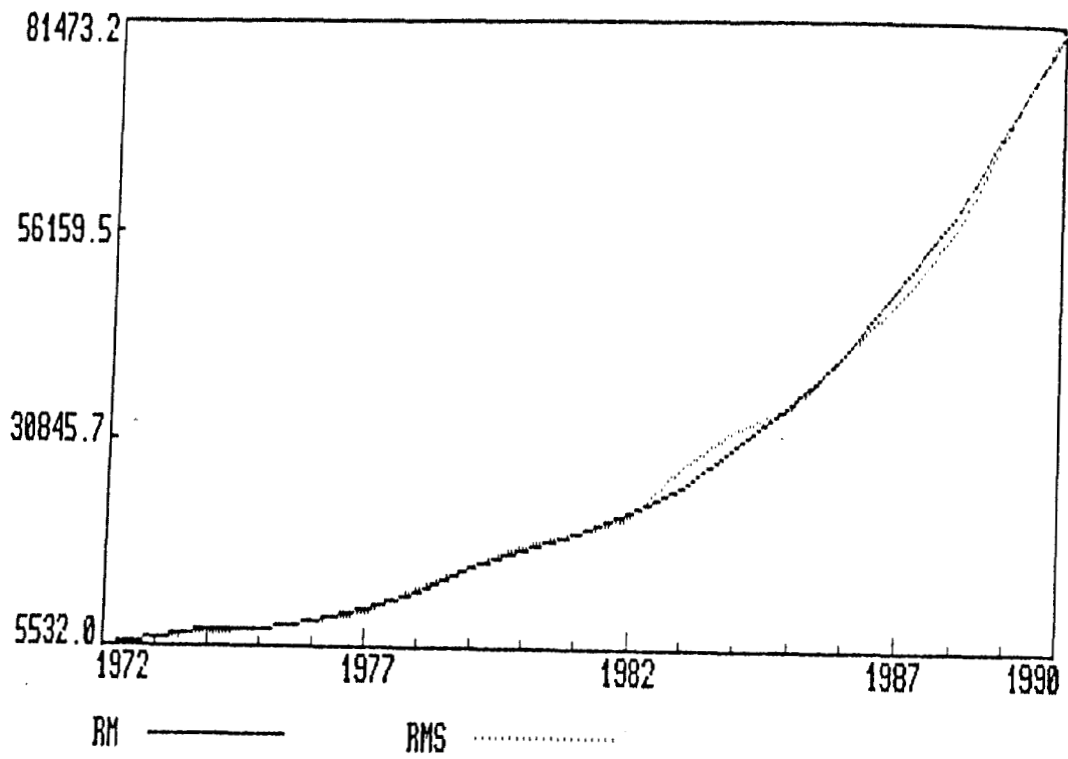
Graph 2: Actual (PH) and Simulated (PIIS) Wholesale Price Index
(Base 1981-82=100)



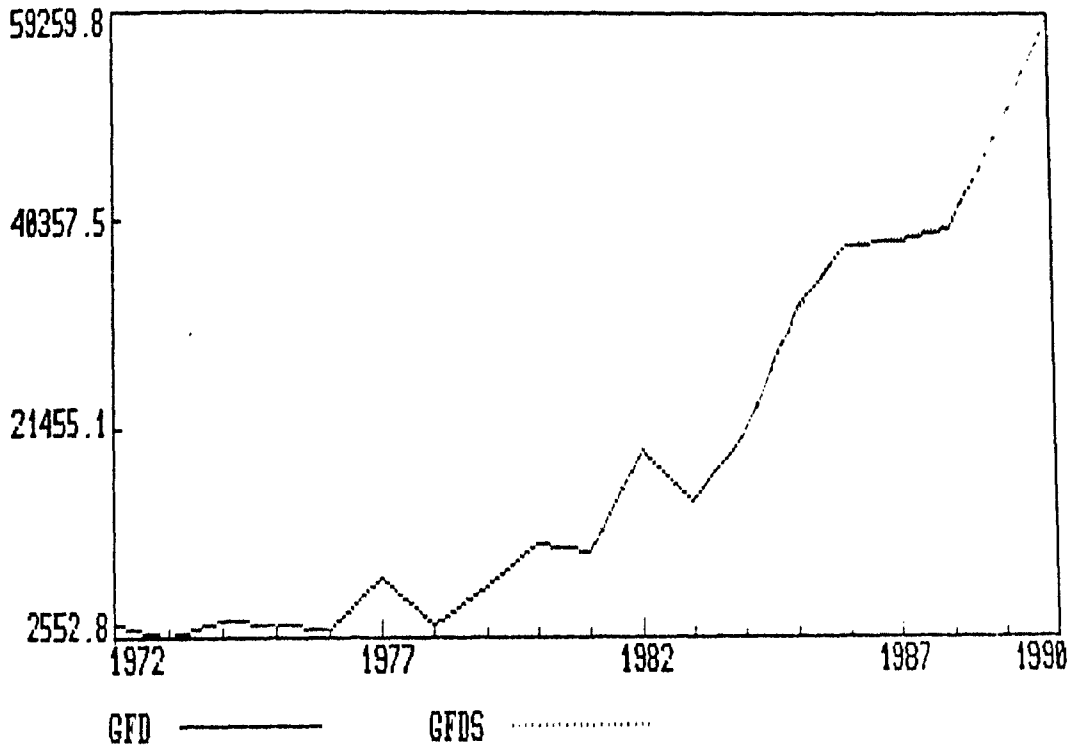
Graph 3: - Actual(M3) and Simulated(M3S) Money Supply
(Rs. Crore)



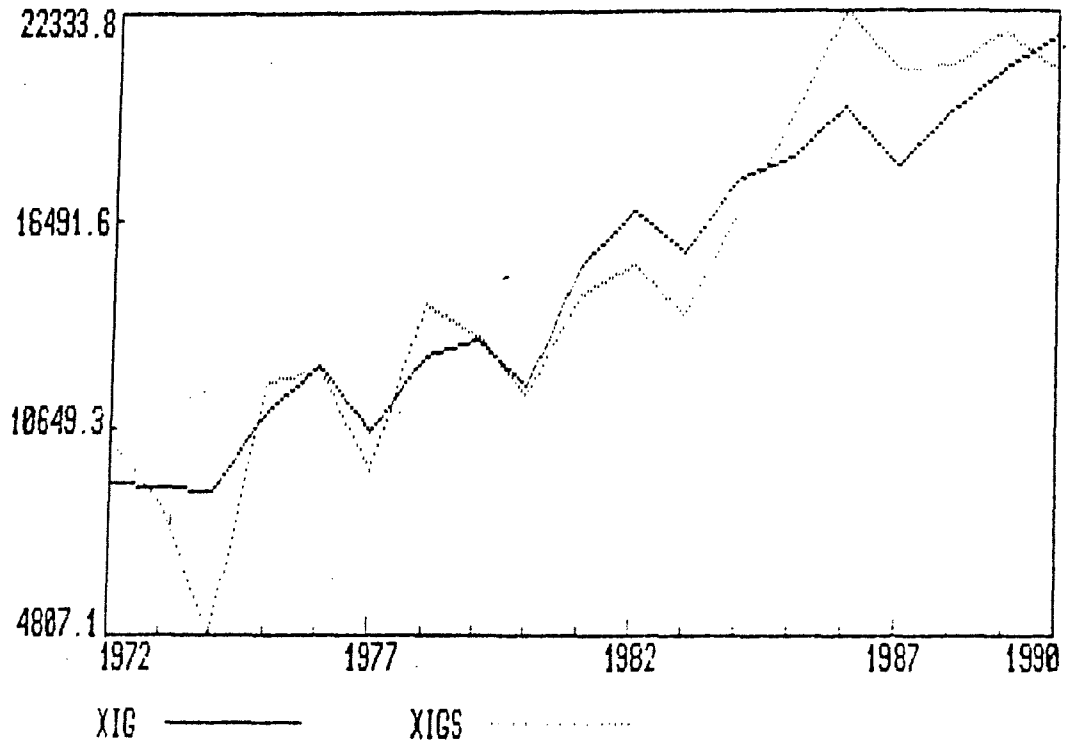
Graph 4: - Actual(RM) and Simulated(RMS) Reserve Money
(Rs.Crore)



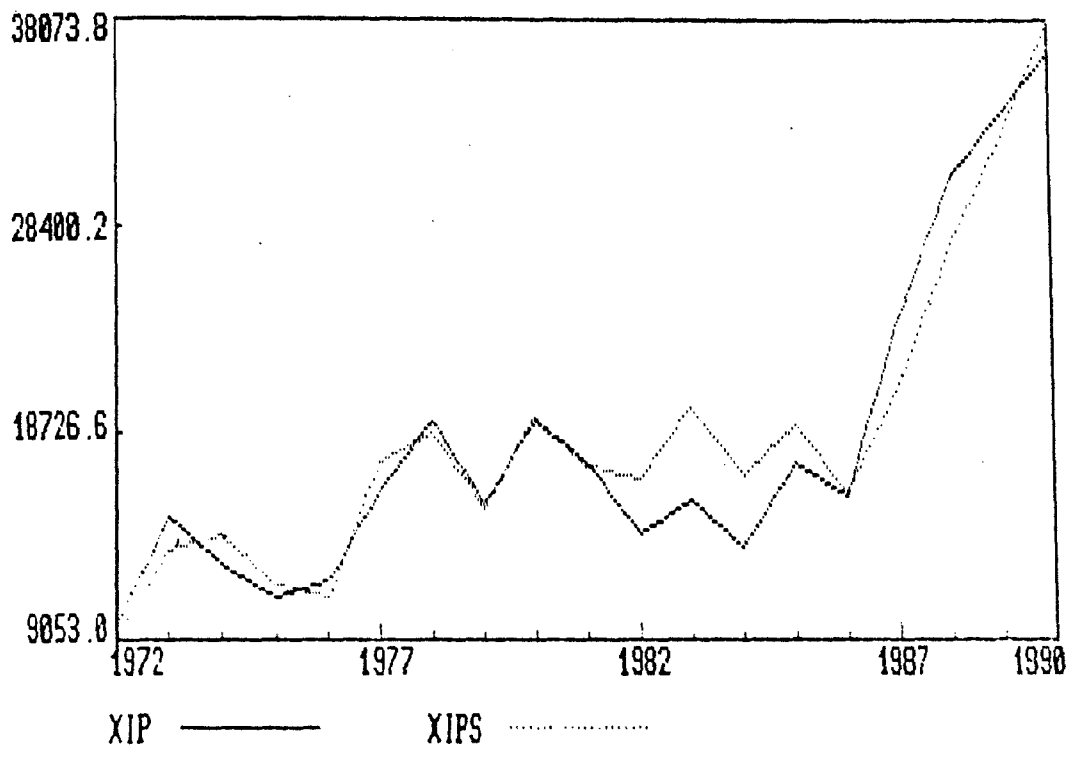
Graph 5: - Actual(GFD) and Simulated(GFDS) Gross Fiscal Deficit
(Rs. Crore)



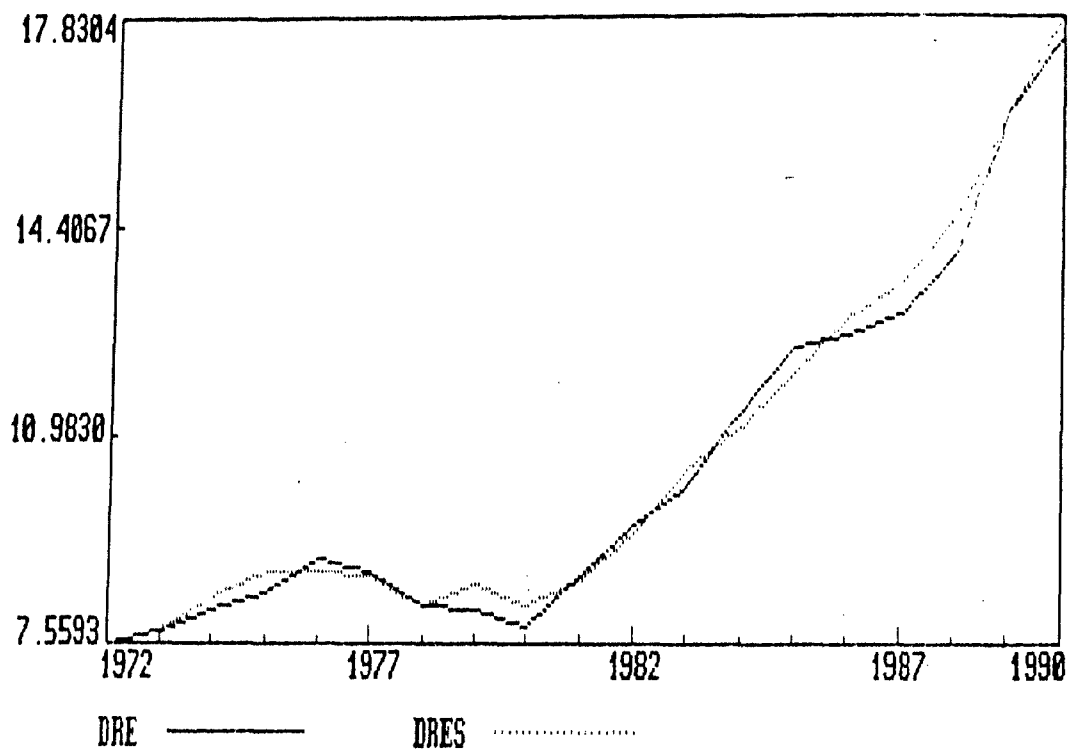
Graph 6:- Actual(XIG) and Simulated(XIGS) Real Public Investment
(Rs.Crore)



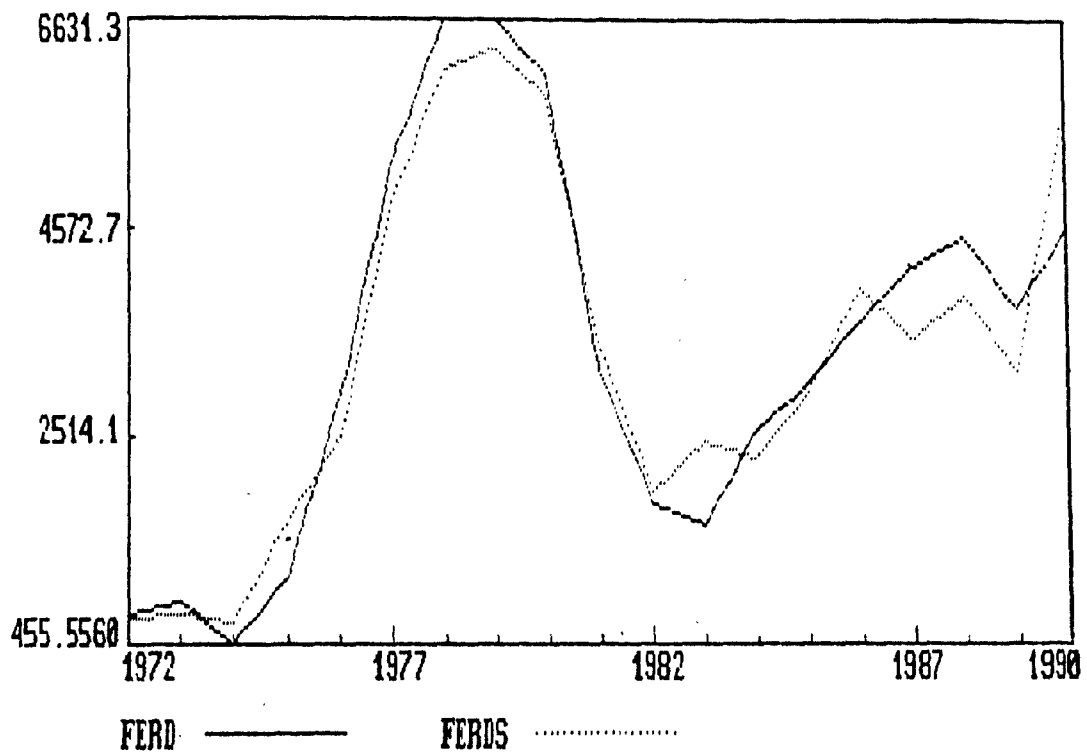
Graph 7:- Actual(XIP) and Simulated(XIPS) Real Private Investment (Rs.Crore)



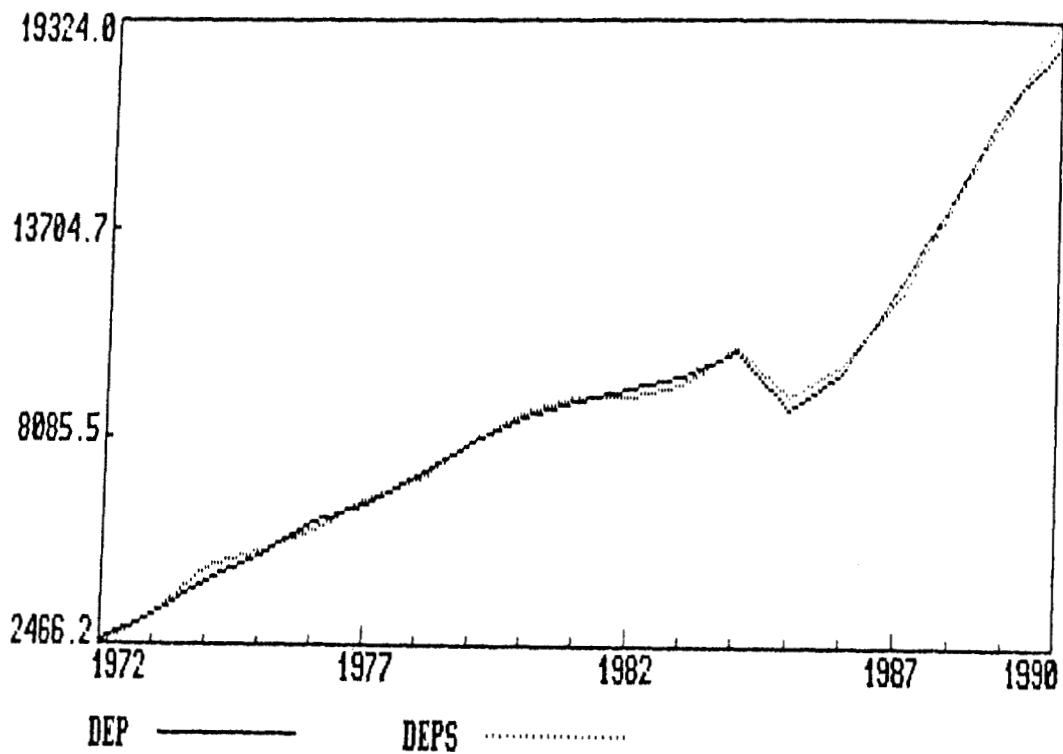
Graph 8:- Actual(DRE) and Simulated(DRES) Dollar-Rupee Exchange Rate
(Rs per \$)



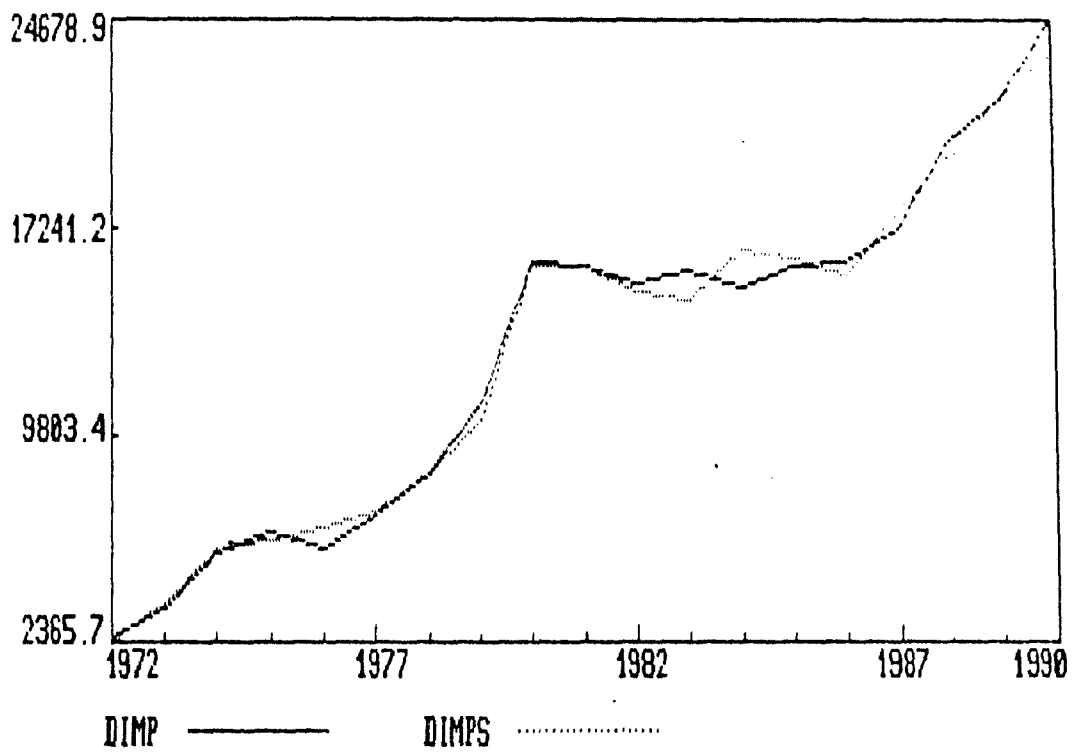
Graph 9: - Actual(FERD) and Simulated(FERDS) Foreign Exchange Reserves (\$millions)



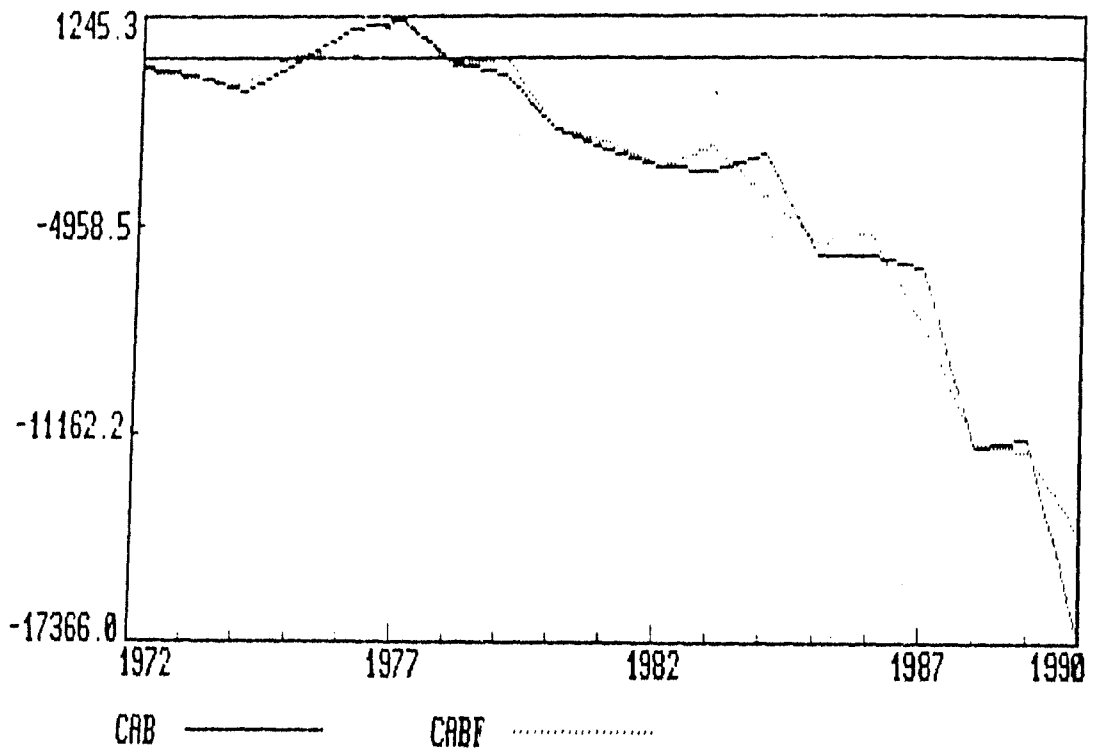
Graph 10:- Actual(DEP) and Simulated(DEPS) Export (\$ million)



Graph 11:- Actual(DIMP) and Simulated(DIMPS) Import(in million dollars)



Graph 12: - Actual (CAB) and Simulated (CABF) Current Account Balances (Rs. Crore)



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