

Macro economic effects of changes in selected monetary and fiscal variables for India¹

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Abstract

This paper attempts to build an aggregative, structural, macro-econometric model for India. The model is monetarist in focus and extends the work of Rangarajan and Arif to include the external sector. Annual time series data for the period 1972-2001 are used for this purpose. To overcome the problem of non-stationarity of the variables, the estimated equations are specified in growth-rate form and three-stage least squares method of estimation is used. The model is validated for its in-sample and out-of-sample forecasting ability. A few counterfactual simulations are undertaken to illustrate the usefulness of the model for analysing the policy options in a simultaneous equations framework.

A sustained increase in RBI credit to commercial sector seems to affect few of the endogenous variables considerably. In the immediate and short run, an increase in RBI credit would lead to increase in reserve money and money supply significantly. This rise in money supply will cause moderate increase in real output and prices. In the external trade sector, exports seem to fall, imports will rise and balance of payments seems to decline. These effects get reversed in medium to long run. The above policy change causes no significant effect on investment variables at any point of time.

A reduction in nominal foreign direct investment does not seem to affect most of the endogenous variables significantly, in the immediate and short run. However, there are substantial effects over medium and long run due to such an exogenous sustained change. These changes are driven by decline in foreign exchange reserves and money supply. The fall in money supply results in marginal decline in real output and prices. Further, there are sizable changes in the trade sector. These include rise in real export demand due to fall in unit value of exports and fall in real imports. But, the balance of payments continues to worsen.

As another model variant, money supply was made exogenous to compare the results of changes in fiscal and monetary policies, viz., (a) rise in govt. real capital expenditure and (b) increase in money supply. Fiscal policy change seems to increase real output with lesser inflation than the envisaged change in monetary policy. There are no significant changes in investment variables due to increase in money supply. Increase in govt. real capital expenditure seems to cause private corporate investment to rise marginally as a crowding-in effect. Balance of payments seems to improve over time due to increase in real govt. expenditure, where as it deteriorates in the event of increase in money supply.

¹ This paper is based on the M.Phil. dissertation of the first author submitted to the University of Hyderabad.

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1.Literature Review:

This paper attempts to utilise the tool of an aggregative, structural, macro-econometric model to analyse the macro economic effects of changes in selected monetary and fiscal variables for India. Before we give the details of the selected model, its estimation etc., it would be useful to look at briefly the literature on this topic for India.

A detailed review of macro models built for Indian economy is beyond the scope of this paper³. Since this study proposes to deal with the monetary sector, it would be worthwhile to look into how the monetary sector was modelled in Indian context⁴. It will be useful for identifying the research issues pertinent to this study.

There was no mention about treatment of the monetary sector in the earlier models. After 1970s, modelling monetary sector and its links with fiscal and external sectors became a challenging task in India. Modelling money and monetary policy for the determination of real output and price level has increased considerably in India. These issues were highlighted in models built by Rangarajan and Arif (1990), Rangarajan and Mohanty (1997). In these models, stock of money varies endogenously through feedback from reserve money, which changes to accommodate fiscal deficit and changes in foreign exchange reserves. The price level is determined by money supply and production. The output supply is determined as a function of real money balances and investment with lags. In this formulation, it is argued that reserve bank credit to finance public sector investment leads to monetary expansion and investment, which together may lead to higher output with a lag. Some models attempt to link the real, monetary and fiscal sectors. Models by Rangarajan and Arif (1990), Jadhav and Singh (1990), Pandit and

³ An excellent review of macroeconometric models built for India can be found in Krishnamurty (2001).

⁴ A good review of monetary sector models was provided by Jadhav (1990).

Krishnamurty (1984) exhibit this form of linking. Public capital expenditure adds to real capital stock which in turn affects the level of real output.

The analysis of effect of public investment on private investment indicates crowding-in, in the sense that the infrastructure facilities created by public investment provide incentive for the private sector to invest (Krishnamurty, 1985). More recent assessment suggests the weakening of this phenomenon in the last decade possibly due to resource constraint and the negative price effect of public sector investment financed by fiscal deficit (Krishnamurty, 2001).

There has been a shift from the net domestic assets to the net foreign assets on the resources side of money base. This is because of the recent policy of financial liberalization and the ensuing changes in the monetary policy, i.e. relying more on market based indirect measures than the direct monetary controls. These issues have been addressed by modelling the money supply process in India during the 1990s (Rath, 2001). Professor Nachane, in a recent paper, has discussed the impact of liberalisation on monetary policy and the link between monetary base and money supply for the post reform period (Nachane, 2001).

2. Methodology:

This paper attempts to utilize a recently built macro-econometric model for India by the first author, as part of her M.Phil. dissertation. A few improvements in that model to address the issues of the present conference are also made. The basic model in the cited study (as well as this paper) is monetarist in focus and extends the work of Rangarajan and Arif (1990) to include the external sector along with a few other modifications. The model emphasises the inter-relationships among money, output, prices and balance of payments.

The model strives for a balance between the two polarized approaches of the classicals and the Keynesians. While classicals contend that changes in money supply, ultimately results in changes in price level, the Keynesians on the other hand postulate that the changes in money supply eventually leads to changes in output, under conditions of less than full employment. Viewing reality lying somewhere in between these two extremes, one can postulate that changes in money supply affect both output and price level. Thus, the model tries to capture the effects of changes in money supply resulting in both output and price level.

The model mainly focuses on the determination of money supply and its links with fiscal operations and on the impact of money stock on output generation. It is postulated that real money balances or credit along with the real capital stock affects output. An increase in real credit results in monetary expansion, which in turn has an effect on output, and price level. A rise in output through increase in credit dampens the rise in price level caused by monetary expansion.

Further, RBI credit to finance the resource gap, which is defined as govt. total expenditure less govt. total receipts, causes money supply to increase endogenously with the rise in reserve money. This monetary expansion again affects the price level and output to a lesser extent, and the cycle continues.

In addition, external sector is also modelled by including supply and demand for exports, demand for imports and the BOP identity. Assuming equilibrium in the exports market, the export supply function is specified as a price equation for unit value of exports. It also incorporates real income and relative price factors of India and the rest of the world. The export demand depends on relative export prices and world income

excluding that of India, thereby capturing the influence of world economic activity on India's exports. The import demand function is based on the domestic income level, relative import prices and the (foreign exchange) reserves capacity to pay for imports. The model structure can be summarized as shown below:

3. Model:

1. $YR = f((M3/WPI), KGR)$
2. $GCER = f(YR, GCER_{(-1)})$
3. $GRR = f(YR * WPI)$
4. $GBBS = f(ADEP, SLR)$
5. $ADEP = f(M3)$
6. $WPI = f(M3, YR, WPI_{(-1)})$
7. $NID = f(WPI)$
8. $KPGR = f(GKER)$
9. $KPCGR = f(KPGR, YR_{(-1)})$
10. $GCE = GCER * WPI$
11. $GKE = GKER * WPI$
12. $GTE = GCE + GKE$
13. $GMB = \Delta GBBS + GBNB$
14. $GCR = GMB + GNMB + GEB$
15. $RM = RBCG + RBCC + RBCS + RBFA + GCL - RNML$
16. $M3 = M_t * RM$
17. $Y = YR * NID$
18. $KGR = KPGR + KPCGR + KPUGR$

$$19. UVEXP = f (WPI/EXR, WP, WIR, YR, EXPR_{(-1)},)$$

$$20. EXPR = f (UVEXP/WP, WIR, EXPR_{(-1)})$$

$$23. IMPR = f ((UVIMP*EXR)/WPI, YR, RBFA/(UVIMP*EXR))$$

$$24. RBFA = RBFA_{(-1)} + EXR (UVEXP*EXPR - UVIMP*IMPR) + FDI + NIF$$

Endogenous variables:

1. YR: Real national income (NNP at FC)
2. Y: Nominal national income (NNP at FC)
3. GCE: Current account expenditure of the government
4. GKE: Capital expenditure of the Government
5. GTE: Total expenditure of the Government
6. GCER: Real current account expenditure of the Government
7. GRR: Revenue receipts of the Government
8. GCR: Capital receipts of the Government
9. GBBS: Borrowings of the Government from banks
10. GMB: Market borrowings of the Government
11. GNMB: Non-market borrowings of the Government
12. ADEP: Aggregate Deposits with Banks
13. RBFA: Net foreign exchange assets of RBI
14. RM: Reserve money (M1)
15. M3: Broad money
16. NID: Price deflator for national income
17. WPI: Wholesale price index
18. KGR: Gross Real Capital Stock: Aggregate
19. KPGR: Gross Real Capital Stock: Public sector
20. KPCGR: Gross Real Capital Stock: Private corporate sector
21. EXPR: Real exports
22. UVEXP: Unit value of exports
23. IMPR: Real imports

Exogenous variables:

1. GKER: Real capital expenditure of the Government
2. GEB: Government external borrowings
3. RBCG: RBI credit to the Government
4. GBNB: Government borrowings from the non-banking financial institutions
5. RG: Resource gap
6. RBCC: RBI credit to the commercial and co-operative banks, and NABARD
7. RBCS: RBI credit to the commercial sector
8. SLR: Statutory liquidity ratio
9. GCL: Government current liabilities to the public
10. RNML: RBI's net non-monetary liabilities

11. KPUGR:	Gross Real Capital Stock: Unorganised private sector
12. EXR:	Exchange rate
13. IMPR:	Real Imports
14. UVIMP:	Unit value of imports
15. FDI:	Foreign direct investment
16. NIF:	Net inflows
17. WIR:	World income excluding India
18. WP:	World wholesale price index excluding India
19. DUMMY:	Dummy variable for economic reforms
20. M_t :	Money multiplier

As stated above, the model pays attention on the link between money supply and fiscal operations. The distinguishing feature of the model is to include the lagged real money balances ($M3/WPI$) or credit as a factor of production along with the lagged real capital stock (KGR) in the production function.

The government operations are modelled by a set of equations. Total expenditure of the govt. (GTE) is taken as the sum of current expenditure (GCE) and capital expenditure (GKE). While the latter is taken as exogenous or policy determined, but the current expenditure of the government in real terms ($GCER$) is determined according to a partial adjustment process related to the real income. Nominal revenue receipts of the govt. (GRR) are related to nominal income. The nominal capital receipts of the govt. (GCR) consist of govt. market borrowings (GMB), non-market borrowings ($GNMB$) and external borrowings of the govt. (GEB). Market borrowings of the govt. is the sum of changes in govt. domestic borrowings from banks ($\Delta GBBS$) that are reflected by the banks net-investment in govt. securities, and borrowings from financial institutions other than banks ($GBNB$). Non-market borrowings comprises of small savings, provident funds, special borrowings from RBI against compulsory deposits and other capital receipts. Govt. borrowings from banks are a function of aggregate deposits with banks ($ADEP$), which in

turn is related to money supply. The resource gap is financed through credit from RBI ($\Delta RBCG$), over and above other borrowings. The link between fiscal and monetary sectors is established by making RBI credit to govt (RBCG) as a component of reserve money (RM), which in turn is related to money supply (M_3) through money multiplier (M_t). The other components of reserve money are, RBI credit to commercial sector (RBCS) and commercial banks, co-operative banks (RBCC), net foreign exchange assets of the RBI (RBFA), govt. currency liabilities (GCL) less net non-monetary liabilities of the RBI (RNML). Demand for money is expressed in terms of a price equation where price level (WPI) is related to money supply, real income, lagged prices. The national income deflator (NID) is related to WPI. Real capital stock (KGR) is decomposed into gross real capital stock in public sector (KPGR), private corporate sector (KPCGR), and unorganised private corporate sector. KPGR is explained in terms of real capital expenditure of the govt. KPCGR depends on gross real capital stock on public sector and lagged real income.

Coming to the external sector, export supply equation is expressed in terms of unit value of exports (UVEXP), lagged exports, real income, WPI, world price (WP) and real income of rest of the world (WIR). Export demand (EXPR) is explained in real terms, as a function of relative prices, income of rest of the world and lagged exports. The import demand equation is specified as a function of unit value of imports (UVIMP) relative to WPI, real income and desired level of foreign exchange reserves given unit value of imports. The balance of payments (or change in reserves) is equal to the sum of net trade balance and net capital inflows where net capital inflows are decomposed into foreign direct investment and rest of capital inflows. A schematic view of the full model is shown in Chart 1.

4. Empirical results:

The model has 12 equations and 10 identities. Annual data on all the variables was collected for the period 1972-73 to 2001-02. However, the data for the period 1972-73 to 1998-99 only was used for model estimation and the observations from 1999-00 to 2001-02 were used for *ex-post* or post-sample validation of the model.

Since, stationarity of variables is an important issue in econometric estimations, the data was tested for stationarity using the unit root tests. Most of the variables were found to be non-stationary in levels but stationary in rate of change form. Hence, the required 12 equations are estimated in **rate of change** form using 3SLS method of estimation. EViews package has been used for model estimation. Thus, the estimates therefore, possess desirable properties like unbiased-ness and consistency. They will be efficient as well. While estimating the model, a TREND variable is included in most of the equations to capture the autonomous time related changes in the growth rates of the observed series of endogenous variables. A DUMMY variable to separate the pre and post liberalization (1991-92 onwards) periods in the data is also included in the model. Interaction of this DUMMY variable with some of the explanatory variables is also considered.

The 12 estimated equations using 3SLS method are given in Appendix-I. The selection of final form of these equations is based on usual statistical criteria like correct signs of coefficients, significant t-values and high good-ness of fit. Since the estimated equations are in growth-rate form, the regression coefficients can be treated as partial elasticities of the dependent variable with respect to independent variables. The elasticities are computed for the short- and long-run as well as pre- and post-reform periods. The

partial elasticities of all the dependent variables w.r.t. selected independent variables are given in the Table-1. We discuss below the implication of few of these partial responses.

Here, in the first regression, which is a production function, the regression coefficients are output elasticities with respect to factor inputs. From the table, it can be seen that due to a 10% increase in each of these two factor inputs, *ceteris paribus*, the real aggregate output in the economy would increase by 1.3-1.4%. These elasticities are numerically small, implying low output response to changes in real credit or capital stock.

Like wise, from the estimated price equation, for every 10% rise in money stock, general price level rises by 4.6% during pre-reform period and 2.8% in post-reform period. The long-run responses are even larger. A 10% rise in real output, decreases the price level by 11.6% in the short-run and 28.2% in the long run. Coming to investment variables, a 10% rise in govt. capital expenditure leads to, 5.7% and 3.8% increase in capital stock during pre-reform period and in the post-reform period respectively. A 10% rise in public sector capital stock increases private sector capital stock by 1.5% as a crowding-in effect.

The govt. borrowings from banks seems to be effected by aggregate deposits with the banks equi-proportionally, while a 10% increase in SLR will increase govt. borrowings from banks only by 2.8%. Increase in money supply also will have almost an equi-proportional increase in aggregate deposits with banks. Govt. revenue receipts, *ceteris paribus*, will increase with rise in nominal income in the economy, both during pre-reform and post-reform periods, nearly equal rate.

Table – 1: Estimated partial elasticities of the dependent variables w.r.t. selected independent variables

Dependent variable	Independent variables			
YR	(M3/WPI) 0.13		KGR 0.14	
WPI	M3 <u>Pre-reform</u> 0.46 SR 1.11 LR		<u>Post-reform</u> 0.28 SR 0.60 LR	
KPGR	GKER <u>Pre-reform</u> 0.57			
KPCGR	KPGR 0.15		YR₁ 1.73	
GCER	YR 1.31 SR 1.50 LR			
GRR	(YR*WPI) <u>Pre-reform</u> 0.70			
GBBS	ADEP 0.94		SLR 0.28	
ADEP	M3 1.15			
UVEXP	WP 0.37		WIR 0.22	YR 0.99
EXPR	(UVEXP/WP) -1.10 SR -1.14 LR		WIR 0.41 SR 0.42 LR	
IMPR	(UVIMP*EXR/WPI) -0.73 SR -0.91 LR		YR 1.53 SR 1.90 LR	

SR: Short-run; LR: Long-run

Performance of the model:

To assess the empirical adequacy of the full model in describing the historical data, the predicted sample period values (levels) of the 12 endogenous variables are generated successively using the definition of ‘rate of change’ and the estimated rate of change values of each endogenous variable along with an appropriate initial value at the beginning of the series. The observed value in 1973-74 is taken as the initial value for each variable. Thus, the full model has 34 ($=12+12+10$) relationships in total for the purpose of simulation. EViews package was employed to solve the 34 relations together iteratively for each year using commonly required options, namely deterministic simulation and dynamic solving options for the entire sample period, 1972-73 to 2001-02. The simulated values, also called the ‘base simulation’, for the period 1972-73 to 1998-99 are sample period (ex-post) estimates. The ‘base simulation’ values are tuned for adjustment in levels by modifying only the initial 1973-74 values wherever necessary. The assessment of the full model is done by (a) comparing the time series plots of actual and base simulation values and (b) computing the summary measures MAPE, RMPE and Theil’s inequality coefficient, separately for the sample and post-sample periods. Based on all these three criteria, the base simulation could trace the historical data quite well. Due to limitation of space, these details are omitted here.

5. Policy Simulations:

The simulation methodology can also be conveniently used to analyse the impacts of counterfactual scenarios about certain policy variables, among the exogenous variables. Hypothetical sustained changes in each policy instrument are incorporated for a specified sample period and the full model is solved for each year during that sample

period. The time path of each endogenous variable of such a policy simulation is compared and contrasted with the base simulation (not the actual series) as reference path. Such comparison only can facilitate quantification of the impacts of policy change on the endogenous variables, without confounding the effects of the inaccuracies of estimated model.

The monetary policy variables chosen here for this purpose are RBI credit to commercial sector (RBCS), the statutory liquidity ratio (SLR) and the foreign direct investment in India (FDI). Counterfactual simulations are undertaken to illustrate the usefulness of the model for analysing the changes in monetary policy relating to these variables in a simultaneous equations framework.

For comparing the macro economic effects of changes in fiscal and monetary policies, another variant of the model is constructed. For this purpose, the base simulation is recalibrated by making money supply (M3) exogenous in the model. Two additional policy simulations relating to changes in GKER and M3 were undertaken. The simulation results for a few important variables are plotted in Graphs.

The allocative and dynamic macro economic effects due to the above policy changes are also quantified as percentage changes, known as multipliers, with reference to base simulation values at four points of time, namely same year of exogenous change (immediate or instantaneous or impact), after one year (short-term), after five years (medium term) and after ten years (long-term).

It may be mentioned that these percentage responses are contemporaneous in nature (policy simulation vs. base simulation) and should not be treated as usual percentage rate of change over time. For this reason, these responses are likely to be

different from the direct responses (both partial and net) implied by the estimated rate of change equations using 3SLS. The period 1991-2001 is used for all these policy simulations. The scenario results are presented in Tables 2-3.

(a) Sustained 30% increase in RBI credit to commercial sector (RBCS):

RBI credit to commercial sector is an important monetary policy instrument to affect macro economy through changes in money supply. We consider a hypothetical or counterfactual simulation to visualise such a policy change. A sustained 30% increase in RBCS from 1991-92 onwards is simulated. We shall discuss the impacts and dynamic responses of the policy change on all the endogenous variables.

Due to a 30% increase in RBCS, as expected, the first change will occur in reserve money (RM), and thereby money supply. Reserve money and money supply have increased by 2.3% as an immediate response. As a result, price level increased by 0.4%. Since real money balances is a factor of production with positive and significant coefficient (0.13), real output rises marginally (0.2%). Sizable increases occur in most of the monetary and fiscal variables, govt. market borrowings being the largest beneficiary (19.9%). Capital receipts of the govt. will also rise (3.5%). Due to rise in real income, unit value of exports rise (0.3%), thereby reducing export demand (0.4%). Conversely, since unit value of imports being exogenous, rise in real income has led to rise in real imports (0.7%), thereby worsening the balance of payments (5.0%).

In the second and subsequent years, when the policy change is sustained, there will be **system-wide effects**, strengthening of some and weakening of other responses, with an overall slide down in the economy- fall in real output (0.2%), gross capital stock (0.1%), private corporate sector capital stock (0.1%), money supply (2.1%), govt. market

borrowings (4.4%), govt. capital receipts (3.0%) and bank deposits (2.5%) by the year 2001-02. However, consumers may be benefited due to fall in general price level (0.8%). Balance of payments also seems to improve due to subsequent rise in real exports (0.3%) and fall in real imports (0.2%). Thus, sustained increase in RBI credit to commercial sector seems to result in only immediate to short-run benefits to the economy. The long-run effects are likely to be unfavourable. Some of these important scenario effects are shown in Figures 1-3.

(b) Sustained 30% decrease in foreign direct investment (FDI):

Foreign direct investment is a very crucial policy variable in the model. Changes in this variable can cause several macroeconomic impulses that are extremely important in the current discussion of globalisation and economic reforms. Fears are often expressed about the possible sudden withdrawal of foreign direct investment by foreign institutional investors and consequential adverse effects on the Indian economy. Keeping this in mind, we simulated a 30% sustained decrease in nominal foreign direct investment from 1991-92 onwards. The immediate and dynamic effects of such a scenario are quantified in comparison to the base simulation and are presented in Table-2. The FDI variable appears directly as a pure explanatory variable in the foreign exchange reserves (RBF) identity. Therefore, the effects of reduction in FDI will start with this identity and they will percolate to all other relationships in the model in the same year due to simultaneity. However, the magnitude of changes in 1991-92 for many of the endogenous variables seems numerically very small (less than or equal to 0.1%) and hence we see only the direction of changes, but not magnitudes in the table.

Decline in FDI will directly reduce foreign exchange reserves, which will reduce base money (RM), money supply (M3) and real imports (IMPR). Reduction in nominal money supply will trigger a series of second round changes. These include decline in real output, aggregate deposits with the banks, and wholesale price index.

All the above second round effects will lead to more wide spread changes in the third and subsequent rounds in the same year of exogenous FDI reduction. The net year-end changes are noticeable (more than 0.1%) only in the case of two variables, namely balance of payments (-0.5%), and govt. market borrowings (-0.5%). These two changes are the result of a series of systemic effects, which are the hallmark of a simultaneous equations model. It may be mentioned that the direction of all other effects are in accordance with the postulated model.

In the second year, 1992-93, a few more endogenous variables will have sizable changes. Due to sustained reduction in foreign direct investment, the reserves deplete further (-1.8%) thereby causing considerable reduction (-0.2%) in base money (RM) and money supply (M3). As a consequential change, the country's economic activity (YR) will slow down marginally, necessitating cuts in govt. borrowings from banks (GBBS) and aggregate deposits with banks (ADEP). The overall price level will decline in comparison to the base simulation. Due to reduction in FDI (and hence reserves), imports may be discouraged marginally.

The medium (1996-97) and long-term (2001-02) effects are stronger and exhibit continuation of above-mentioned trends. Interestingly, most of the endogenous variables are affected due to decline in foreign direct investment, signifying its importance to the Indian economy. Specifically, these macroeconomic changes include, marginal decline in

output (-0.2%), price level (-1.6%); and money supply (-3.2%) by the year 2001-02. The real capital stock in private corporate sector (-0.3%) and hence in the economy is expected to decline marginally (-0.1%). The real imports will fall (-1.6%), and real exports demand will pickup (0.5%), but net balance of payments will decline (-5.3%).

Most of the fiscal and monetary variables also seem to suffer due to sustained reduction in foreign direct investment. Thus, there is justification for the fears expressed regarding adverse macroeconomic consequences on the Indian economy, in the event of substantial (and sustained) reduction in foreign direct investment.

(c) Sustained 30% increase in Statutory Liquidity Ratio (SLR):

A sustained 30% increase in SLR doesn't seem to affect any of the variables except govt. borrowings from banks (GBBS), govt. capital receipts (GCR) and govt. market borrowings (GMB). In the first year, GMB has increased very rapidly (55.8%) than the other two variables. Govt. capital receipts have gone-up by 9.7% in 1991-92, but the response seems to die down eventually. GBBS rose by 6.7% through out, in conformity with its regression coefficient for SLR (0.28). The localisation of the effects due to changes in this crucial monetary policy variable can be attributed to the absence of link between govt. capital receipts (GCR) and monetised deficit ($\Delta RBCG$). Originally, this link existed in the model, but it could not be retained due to problems of non-convergence of simulation routine. This limitation in the model needs further probing.

(d) Sustained increase in money supply vs. government capital expenditure:

Often the policy maker has to compare two or more policy options and opt one among them for implementation. Two such competing policy options in our model

framework are increase in money supply and increase in govt. real capital expenditure. To implement the first policy option, the existing model needs modification in which the money supply becomes a pure exogenous variable.

This requires dropping the reserve money and money supply identities, but bring-in a new identity relating to Reserve Bank Credit to central Govt. (RBCG). Changes in RBCG are usually termed as monetised deficit, which used to play a very important role in the Indian economy prior to the start of economic reforms process. Since the equations being estimated are unaffected by the above changes, all the 12 estimated growth rate equations using 3SLS remain intact. Only some identities get changed and after incorporating these changes in the model, the base simulation is re-calibrated. The modified base simulation will be used as reference path to compare the above mentioned two policy options.

Unlike in the earlier simulations, we try to bring-in a common feature or 'standardization' for comparison, namely equal percentage deviation in real output (0.5%) from base simulation in the year 1991-92 between the two policy scenarios. This is achieved by trial and error method of changing M3 and GKER variables. The M3 and GKER variables needed respectively 3% and 30% changes in 1991-92 to achieve a 0.5% deviation in real output in 1991-92 alone. The same percentage changes in M3 and GKER are sustained till 2001-02. We believe that this facilitates better comparison than equal percentage change in policy variables. We first discuss the impacts of a 3% sustained increase in money supply on all the remaining endogenous variables including RBCG.

As we mentioned earlier, money supply (which is assumed to be equal to money demand) is one of the most crucial variable in the model. Changes in this variable will

have instantaneous system wide effects. This can be seen from Table-3. Few of them are represented in Figures 7-9. In the first round of changes, a 3% increase in money supply in 1991-92 will raise aggregate real output in 1991-92 itself, since real money balances (or credit) is a factor of production with current time suffix. Aggregate deposits with the banks will rise due to increased liquidity. Wholesale price index will rise to clear the product market. These changes will lead to further changes in the second and subsequent rounds. Significant among these are increase in govt. borrowings from market (25.2%) and banks (3.3%). As a result, capital receipts of the govt. will increase (6.0%). Due to rise in domestic price level, unit value of exports will rise (0.6%), leading to fall in export competitiveness and hence real export demand (-0.7%). But, real imports will rise by 0.8% due to fall in relative prices and rise in real income. The net effect is a fall in balance of payments (-9.8%). The capital stock, both private and public, is unaffected in 1991-92 due to the exogenous rise in money supply. The fiscal variables also increase marginally.

In contrast, the following responses are noticed in 1991-92 due to a 30% increase in govt. real capital expenditure in 1991-92. Due to this policy change, as expected, the largest endogenous change is in govt. nominal capital expenditure (29.3%) and govt. nominal total expenditure (8.5%). The real capital stock in the public sector (9.9%) as well as the economy as a whole will rise (4.0%). There are only minor changes in the other endogenous variables including a 0.5% decline in price level. Thus, the main difference between the two policy options seems to be changes in general price level, public sector capital stock and expenditure. Increase in money supply is inflationary, while increase in govt. capital expenditure is asset creating as well non-inflationary. Both leads to an identical rise in real output (0.5%) in 1991-92. These trends will continue into the

future for both the scenarios. It is interesting to notice that there will be a switch over from govt. market borrowings to RBI credit as 3% increase in money supply is sustained. In the case of 30% sustained increase in govt. capital expenditure, there will be a decline in RBI credit to govt. The balance of payments will also improve (10.7%).

Thus, **to conclude**, this study has analysed the likely macro economic effects of changes in selected monetary and fiscal variables for India. The quantified effects include the allocative and dynamic responses of chosen policy change on important macro economic variables such as real output, investment in public and private sectors, money supply, general price level, real exports, imports and balance of payments in the Indian economy. The sign and magnitude of the effects differ between the two types of policy variables and they vary over time- immediate to long run.

Specifically, the effects of increase in monetary variable like RBI credit to commercial sector seem to be beneficial to the economy **only** in the immediate to short run. However, there can be sustained benefits to the consumer in terms of lower price level due to such a policy change. Sustained withdrawal of foreign direct investment will adversely affect the Indian economy in many ways. Between the two policy options of increase in real govt. expenditure and nominal money supply, as can be expected, the former will be more beneficial than the latter.

Table-2:Impacts and dynamic multipliers (percent) of Hypothetical changes in selected exogenous variables

Endogenous variable	Simulation-1				Simulation-2				Simulation-3			
	1991-92	1992-93	1996-97	2001-02	1991-92	1992-93	1996-97	2001-02	1991-92	1992-93	1996-97	2001-02
YR	0.2	0.1	-0.1	-0.2	-0.0	-0.0	-0.2	-0.2	0.0	0.0	0.0	0.0
Y	0.6	0.4	-0.3	-0.7	-0.0	-0.1	-0.7	-1.4	0.0	0.0	0.0	0.0
NID	0.3	0.3	-0.2	-0.6	-0.0	-0.0	-0.5	-1.1	0.0	0.0	0.0	0.0
WPI	0.4	0.5	-0.3	-0.8	-0.0	-0.1	-0.7	-1.6	0.0	0.0	0.0	0.0
KGR	0.0	0.1	-0.1	-0.1	0.0	0.0	-0.1	-0.1	0.0	0.0	0.0	0.0
KPGR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KPCGR	0.0	0.4	-0.1	-0.1	0.0	-0.0	-0.2	-0.3	0.0	0.0	0.0	0.0
M3	2.3	0.9	-1.1	-2.1	-0.1	-0.2	-2.1	-3.2	0.0	0.0	0.0	0.0
RM	2.3	0.9	-1.1	-2.1	-0.1	-0.2	-2.1	-3.2	0.0	0.0	0.0	0.0
GCER	0.3	0.1	-0.2	-0.2	-0.0	-0.0	-0.3	-0.3	0.0	0.0	0.0	0.0
GRR	0.4	0.3	-0.2	-0.5	-0.0	-0.0	-0.5	-1.0	0.0	0.0	0.0	0.0
GBBS	2.4	1.0	-1.2	-2.2	-0.1	-0.2	-2.2	-3.4	6.7	6.7	6.7	6.7
ADEP	2.6	1.1	-1.3	-2.5	-0.1	-0.3	-2.4	-3.7	0.0	0.0	0.0	0.0
EXPR	-0.4	-0.2	0.1	0.3	0.0	0.0	0.3	0.5	0.0	0.0	0.0	0.0
IMPR	0.7	0.7	0.4	-0.2	-0.0	-0.1	-0.8	-1.6	0.0	0.0	0.0	0.0
UVEXP	0.3	0.1	-0.2	-0.4	-0.0	-0.0	-0.3	-0.5	0.0	0.0	0.0	0.0
Δ (RBFA)	-5.0	-5.4	-2.7	1.7	-0.5	-1.8	-5.9	-5.3	0.0	0.0	0.0	0.0
GCE	0.8	0.6	-0.5	-1.0	-0.0	-0.1	-1.0	-1.9	0.0	0.0	0.0	0.0
GKE	0.4	0.5	-0.3	-0.8	-0.0	-0.1	-0.7	-1.6	0.0	0.0	0.0	0.0
GTE	0.7	0.6	-0.4	-1.0	-0.0	-0.1	-0.9	-1.9	0.0	0.0	0.0	0.0
GCR	3.5	-1.5	-1.4	-3.0	-0.1	-0.3	-2.5	-2.0	9.7	2.8	3.3	0.0
GMB	19.9	-3.4	-2.3	-4.4	-0.5	-0.8	-4.1	-3.0	55.8	6.5	5.3	0.0

Simulation-1: 30% sustained increase in RBCS

Simulation-2: 30% sustained decrease in FDI

Simulation-3: 30% sustained increase in SLR

Table-3: Impacts and dynamic multipliers (percent) of Hypothetical changes in selected exogenous variables

Endogenous variable	Simulation-4				Simulation-5			
	1991-92	1992-93	1996-97	2001-02	1991-92	1992-93	1996-97	2001-02
YR	0.5	0.4	0.3	0.3	0.5	0.5	0.7	0.5
Y	0.7	0.9	1.2	1.3	0.1	-0.1	-0.6	-0.6
NID	0.3	0.5	0.9	1.0	-0.4	-0.7	-1.2	-1.2
WPI	0.4	0.7	1.2	1.5	-0.5	-0.9	-1.7	-1.6
KGR	0.0	0.2	0.2	0.2	4.0	3.8	3.8	2.9
KPGR	0.0	0.0	0.0	0.0	9.9	9.9	9.9	9.9
KPCGR	0.0	0.7	0.5	0.4	1.1	1.9	2.1	2.0
GCER	0.6	0.6	0.5	0.4	0.6	0.7	1.0	0.8
GRR	0.5	0.7	0.9	1.0	-0.0	-0.2	-0.6	-0.6
GBBS	3.3	3.3	3.3	3.3	0.0	0.0	0.0	0.0
ADEP	3.5	3.5	3.5	3.5	0.0	0.0	0.0	0.0
EXPR	-0.7	-0.6	-0.6	-0.7	-0.5	-0.4	-0.4	-0.3
IMPR	0.9	1.2	1.5	1.6	0.2	0.1	-0.3	-0.4
UVEXP	0.6	0.5	0.5	0.5	0.4	0.3	0.3	0.2
$\Delta(\text{RBFA})$	-9.8	-13.6	-6.5	-48.3	-3.0	-1.8	1.0	10.7
GCE	1.0	1.3	1.7	1.9	0.1	-0.2	-0.8	-0.8
GKE	0.4	0.7	1.2	1.5	29.3	28.8	27.8	27.9
GTE	0.8	1.1	1.6	1.8	8.5	7.4	5.2	3.8
GCR	6.0	1.2	1.5	1.4	0.0	0.0	0.0	0.0
GMB	25.2	3.2	2.5	1.7	0.0	0.0	0.0	0.0
RBCG	0.6	1.5	10.4	12.7	0.2	0.3	-0.3	-2.1

Simulation-4: 3% sustained increase in M3

Simulation-5: 30% sustained increase in GKER

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Appendix-I

Estimated equations using 3SLS method (t-values in paranthesis):

$$1) \text{GrYR} = 0.0191^{**} + 0.1270^{**} \text{Gr(M3/WPI)} + 0.1393^{*} \text{GrKGR} + 0.0008^{***} \text{TREND} - 0.4158^{*} \text{AR (1)}$$

(1.98) (2.03) (2.53) (1.56) (-2.59)

$$R^2 = 0.26, \quad DW = 2.20$$

$$2) \text{GrGCER} = 1.3133^{*} \text{GrYR} - 0.0001 \text{TREND} + 0.1217^{***} \text{GrGCER}_{(-1)}$$

(4.89) (-0.11) (1.35)

$$R^2 = 0.14, \quad DW = 1.90$$

$$3) \text{GrGRR} = 0.7000^{*} \text{YR*WPI} - 0.1188 (\text{DUMMY*Gr(YR*WPI)}) + 0.0028^{**} \text{TREND}$$

(5.97) (-0.60) (1.83)

$$R^2 = -0.30, \quad DW = 1.74$$

$$4) \text{GrGBBS} = 0.9372^{*} \text{GrADEP} + 0.2769 \text{GrSLR} + 0.0021^{***} \text{TREND} - 0.3275^{*} \text{AR (1)}$$

(8.32) (1.23) (1.49) (-2.53)

$$R^2 = 0.30, \quad DW = 2.49$$

$$5) \text{GrADEP} = 1.150^{*} \text{GrM3} - 0.0012^{*} \text{TREND}$$

(32.99) (-2.97)

$$R^2 = 0.52, \quad DW = 2.56$$

$$6) \text{GrWPI} = 0.4574^{*} \text{GrM3} - 1.1586^{*} \text{GrYR} - 0.1771^{**} (\text{DUMMY*GrM3})$$

(5.18) (-5.22) (-1.83)

$$+ 0.0016 \text{TREND} + 0.5896^{*} \text{GrWPI}_{(-1)}$$

(1.21) (6.57)

$$R^2 = 0.24, \quad DW = 2.12$$

$$7) \text{Gr NID} = 0.7322^* \text{GrWPI} + 0.0016^* \text{TREND}$$

$$(17.74) \quad (5.49)$$

$$R^2 = 0.79, \quad DW = 2.06$$

$$8) \text{GrKPGR} = 0.5671^* \text{GrGKER} - 0.1820 (\text{DUMMY}^* \text{GrGKER}) + 0.0013 \text{TREND}$$

$$(4.01) \quad (-0.66) \quad (1.09)$$

$$R^2 = 0.29, \quad DW = 2.58$$

$$9) \text{GrKPCGR} = 0.0281 + 0.1514 \text{GrKPGR} + 1.7279 \text{GrYR}_{(-1)}$$

$$(0.29) \quad (0.35) \quad (1.09)$$

$$R^2 = 0.004, \quad DW = 2.29$$

$$10) \text{GrUVEXP} = 0.2231 \text{Gr(WPI/EXR)} + 0.3662^{***} \text{GrWP} + 0.2222^{**} \text{GrWIR}$$

$$(0.82) \quad (1.34) \quad (2.13)$$

$$+ 0.9923^{**} \text{GrYR} - 0.0050^* \text{TREND} + 0.1399 \text{GrEXPR}_{(-1)}$$

$$(2.22) \quad (-3.25) \quad (1.15)$$

$$R^2 = 0.39, \quad DW = 2.11$$

$$11) \text{GrEXPR} = -1.1024^* \text{Gr(UVEXP/WP)} + 0.4090^* \text{GrWIR} + 0.0330 \text{GrEXPR}_{(-1)}$$

$$(-7.33) \quad (5.04) \quad (0.31)$$

$$R^2 = 0.49, \quad DW = 1.86$$

$$12) \text{GrIMPR} = -0.7325^* \text{Gr}((\text{UVIMP}^* \text{EXR})/\text{WPI}) + 1.5321^* \text{GrYR}$$

$$(-9.78) \quad (3.82)$$

$$+ 0.0040 \text{Gr(RBFA}/(\text{UVIMP}^* \text{EXR})) + 0.00004 \text{TREND}$$

$$(0.14) \quad (0.03)$$

$$+ 0.1942^{**} \text{GrIMPR}_{(-1)}$$

$$(2.39)$$

$$R^2 = 0.72, \quad DW = 2.19$$

*: Significant at 1% level, **: Significant at 5% level, ***: Significant at 10% level.