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# Fiscal Deficit, External Balance and Monetary Growth — A Study of Indian Economy

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The paper examines the various macroeconomic impacts of fiscal deficit in India with special emphasis on the nature of relationship between deficit, external balance and monetary growth. The macro model developed in the paper provides an integrated framework to study the various dimensions of fiscal deficit and in this context to evaluate different policy options for maintaining sustainable internal and external balances in the Indian economy. The policy simulation results reveal that fiscal deficit in general results in widening of current account deficit in the balance of payments, although this outcome critically depends on how the deficit is financed. In the case of monetary financing scenario, the price and income effects reinforce each other, leading to a deterioration in the external balance in the short run as well as in the long run. Thus, in any effort to maintain a sustainable balance of payments situation, domestic economic policy aimed at maintaining absorption and prices at appropriate levels has an important role to play. The paper observes that resort to deficit financing to promote public investment and growth involves costs in terms of loss of control on inflation. Even when the deficit is financed by borrowing from the market, a prudent limit for such borrowing becomes essential.

## Introduction

The external dimensions of the fiscal deficit have been a concern to the policy makers in developing countries. An endemic deficit in the external current account and a domestic saving-invest-

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ment gap, or what may be referred to as the twin gap problem, are the typical outcome of development strategies that depend on budget deficits on a continuing basis to promote domestic capital formation and growth. While a moderate government deficit corresponding to a sustainable current account gap may be desirable in building up domestic capital formation, a persistently large fiscal gap however, may turn the external payment situation unsustainable. Persistent high levels of current account deficit poses both a short term risk and a long term problem. To the extent that it generates an unfavourable market sentiment, the adverse effects on interest rate and exchange rate could turn the domestic policy unsustainable. The long term problems manifest through increased debt service payments, erosion in the long run investment prospects and a sustained loss of confidence in the economy. It is in this context that the measures to reduce domestic absorption and improve public saving constitute important policy ingredients of the adjustment towards creating a sustainable balance of payment environment.

The interrelationship between the fiscal deficit and external balance is evident from the following national income identity which links domestic saving - investment gap to the current account gap in the balance of payments.

$$(X-M) = Y-(C+I+G) = (S_g-I_g) + (S_p-I_p) \qquad ...(1)$$

The above identity states that the current account deficit (X-M) is the excess of domestic absorption i.e. consumption (C), investment (I) and government expenditure (G) over income (Y); or stated differently, foreign saving equals the sum of the saving and investment gap of the public sector ($S_g - I_g$) and that of the private sector ($S_p - I_p$). It is obvious therefore, that policies that reduce private savings and increase budget deficit lead to a deterioration in current account deficit. While equation (1) is an *ex-post* accounting identity and has to be satisfied for each period, the actual dynamics of the transmission of a fiscal deficit to the external current account needs to be worked out by identifying the routes through which domestic economic variables affect the external sec-

tor. The theoretical and empirical literature on transmission mechanism in the open economy context have made considerable progress over the years. Beginning with the basic Keynesian and absorption models, the empirical research in this area has proliferated in many directions to account for the complex behavioural interactions between public and private sectors as also among the various sectors within the economy, both in the static and intertemporal framework [see for example Polak (1957), Crips and Godley (1976) on Cambridge Economic Policy Group (CEPG) model, Khan and Knight (1981), Frenkel and Razin (1987), Haque *et al* (1990), Bartoli (1989) and Mansur (1989)]. The subject has also received a fair amount of attention in India in the context of the on-going stabilisation and structural adjustment programmes [Rakshit (1991), Mohanty and Joshi (1992), Sau (1992), Bhattacharya *et al* (1994), Rangarajan (1994), Rao and Singh (1995), Krishnamurty and Pandit (1997) and Mohanty (1997)].

This paper outlines an empirical model for the Indian economy to study the dynamic interrelationship between the internal and external balances in the economy. The model covering the period 1971-72 to 1993-94 provides an analytical framework for tracing the income and price routes of adjustment from fiscal deficit to current account deficit in the balance of payments. The main linkages in the model are as follows. Fiscal deficits increase the aggregate demand level in the economy and may influence output (in the absence of supply constraints), disposable income, consumption and investment, thus raising the import demand at each stage of transition. Given the availability of borrowed resources from non-monetary and external sources, a part of the deficit is financed by resorting to borrowing from the Reserve Bank. The stock of money therefore evolves endogenously through the feed-back from reserve money which varies with the changes in fiscal deficit. The money stock along with output determines the price level in the economy, which in turn determines the relative prices of imports and exports. To the extent that the nominal exchange rate deviates from its full purchasing parity level, given the domestic and world price levels, fiscal deficit financed by money creation leads to appreciation of real exchange rate, leading to a rise in imports and

decline in the competitiveness of exports. The resulting current account deficit creates a financing need and increases the stock of external debt and interest payment, reinforcing the initial deterioration in the current account balance. A further source of transmission may stem from the changes in the financial balance of the private sector which is behaviourally linked to the government deficit. The prototype model is simulated to conduct certain counterfactual experiments on the policy implications of an increase in fiscal deficit.

The rest of the paper is organised as follows. Section I presents a discussion on the trends in government finances, monetary and real sectors and external balance. Section II outlines the analytical framework and the major features of the model. Section III presents the empirical estimates of structural parameters, while Section IV outlines the complete model and its simulation performance. The results of policy simulations are discussed in Section V, followed by concluding observations in Section VI.

## Section I
## Trends in Major Economic Indicators during 1970-71 to 1993-94

The fiscal balance of the public sector during 1970s and 1980s showed a distinct deterioration. Total current revenue of the public sector including the savings of departmental and non-departmental public enterprises, which increased from 14.4 per cent of GDP in 1970-71 to 22.8 per cent in 1990-91, came down to 22.2 per cent in 1993-94. At the same time, total public expenditure which expanded from 18.0 per cent of GDP to 31.6 per cent of GDP between 1970-71 and 1990-91, saw a little more than one percentage point decline to 30.2 per cent in 1993-94, following the expenditure adjustment measures initiated since 1991-92. Public sector fiscal deficit, defined as the excess of public sector expenditure on consumption, transfer payment and investment over the current revenue (as in the National Account Statistics) increased from 3.6 per cent of GDP in 1970-71 to 8.8 per cent in 1990-91, but fell to below 8 per cent on an average in the next three years.[1] Alongside

the increase in resource gap, the composition of government spending underwent a major change during this period. While government consumption increased from 8.8 per cent of GDP in 1970-71 to 11.2 per cent of GDP in 1993-94, that of transfer payments rose almost four times from 2.7 per cent to 10.4 per cent of GDP during this period. Gross investment of public sector, on the other hand, leap-froged from 6.5 per cent of GDP to 9.7 per cent of GDP in 1990-91 before declining steadily to 8.6 per cent in 1993-94 and its gross savings declined from 2.9 per cent of GDP in 1970-71 to 0.6 per cent in 1993-94.

In the monetary sector, the broad money stock (M3) grew by an annual average rate of 17.4 per cent during 1970-71 to 1993-94 which was essentially brought about by an annual average increase of 15.4 per cent in the outstanding Reserve Bank credit to the government. The annual average inflation rate was placed at 8.8 per cent during this period with the highest inflation rate being recorded at 25.2 per cent in 1974-75 and the lowest being a negative of -1.1 per cent in 1975-76. During the period 1970-71 to 1993-94, real GDP at factor cost grew by an average rate of 4.3 per cent, marked by two years of negative growth in 1972-73 and 1979-80, and the highest growth of 10.6 per cent in 1988-89. Private sector economic behaviour in terms of its consumption and investment pattern revealed certain notable changes during this period. While real consumption of the private sector as a proportion of GDP at constant market prices declined from 75.4 per cent in 1970-71 to 61.6 per cent in 1993-94, its real investment increased from 10.6 per cent to 12.8 per cent during this period. The surplus saving of the private sector over its investment increased from an average of 3.8 per cent of GDP in 1970s to 4.6 per cent in 1980s and 6.8 per cent during 1990-91 to 1993-94, thus counteracting, to some extent, the deterioration in the saving-investment gap of the public sector, which averaged 4.7 per cent in 1970s, 7.7 per cent in 1980s and 7.6 per cent during 1990-91 to 1993-94.

On the external side, nominal merchandise exports (in Rupees) according to the balance of payments data grew by 17.5 per cent

on an average during 1970-71 to 1990-91, which was outpaced by the growth of 18.6 per cent in merchandise imports. Thus, the trade deficit widened from 1.0 per cent of GDP in 1970-71 to 3.2 per cent in 1990-91. During the first three years following economic reforms, export and import growth averaged 29.1 per cent, and 16.9 per cent, respectively, and trade deficit declined to 1.3 per cent of GDP. A part of the deterioration in the trade balance during 1970s and 1980s was caused by the adverse movement of relative prices in the trade sector. On the export price front, the unit value index of export rose at an annual average rate of 9.7 per cent during 1970-71 to 1990-91. The nominal exchange rate of Rupee with respect to US $ during the same period recorded an average rate of depreciation of 4.6 per cent, which was well below the domestic rate of inflation. While the unit value index of imports registered an annual average increase of 11.6 per cent, much of this increase was concentrated on the price inelastic segment of imports. During the post-reform period export prices recorded a sharp deceleration from 26.3 per cent in 1991-92 to 12.5 per cent in 1993-94, following the depreciation of the Rupee by 36.4 per cent in 1991-92 and 25.2 per cent in 1992-93. The rate of depreciation fell to 2.3 per cent in 1993-94, with a large inflow of capital from abroad. There has been a steady fall in import prices growth in the post reform period from 15.5 per cent in 1991-92 to -1.2 per cent in 1993-94. Taking into account the invisibles, transfers, investment income and other miscellaneous receipts, total current receipts in the balance of payments accounts recorded an average growth of 16.7 per cent as compared with the increase of 18.5 per cent in current payments during 1970-71 to 1990-91. During the post-reform period ending 1993-94, current receipts and current payments grew at an average rate of 30.2 per cent and 18.3 per cent, respectively, resulting in a considerable strengthening of the balance of payments. The current account balance during the period 1970-71 to 1993-94 remained in deficit throughout with the exception of 1973-74, 1976-77 and 1977-78. In terms of ratio to GDP, current account deficit which averaged 1.1 per cent during 1970-71 to 1990-91 fell to 0.9 per cent during 1991-92 to 1993-94.

To summarise, the above trends in economic indicators underlined four major developments in the domestic sector which have had implications for the external sector. First, the persistent imbalance in the public sector saving-investment gap has been a primary source of the increase in the current account deficit in the balance of payments. The increase in private sector financial surplus only partly counteracted this deterioration. Second, the shift in the composition of government expenditure towards consumption and transfer payments led to a decline in public sector savings performance and choked the prospects for non-inflationary financing of public investment and growth. This was also a primary reason for increase in domestic absorption relative to output growth. Third, the high reliance on monetary financing to meet the public sector resource shortfalls led to an increase in domestic inflation, thereby adversely affecting the relative prices in the external sector. This was mainly reflected on the increase in the supply price of exports. Fourth, the misalignment of exchange rate, especially during the first half of 1980s with the domestic inflation rate *versus* the inflation rates of our major trade partners resulted in loss of competitiveness of exports and built-in price bias towards imports. The situation was corrected in the post-reform period by effecting a major readjustment of the external value of the Rupee and gradually moving over to a market based exchange rate system.

Given the above backdrop of trends in major economic variables, the following section presents an analytical framework to study the various inter-linkages among the fiscal, monetary, real and external sector of the Indian economy.

## Section II
## Framework of the Model

Theoretical literature discusses two major channels of transmission of fiscal impulses to the external sector *viz.*, the income and the price routes of transmission. Fiscal deficits, whatever may be their intended purpose, almost immediately increase the aggregate absorption level in the economy relative to output. The output effect of deficit follows subsequently as government investment outlay

raises the capital stock in the economy and as firms respond to domestic demand conditions by utilising the excess capacity already available with them. Therefore, while imports may grow, as a consequence of the increase in absorption, the output effect will generate a chain of secondary impacts on demand for imports through disposable income, private consumption and investment. A further channel of transmission takes place through the relative price changes brought about by the financing side of deficit. When the fiscal deficit is entirely financed by issue of bonds to private sector, the monetary impact of such fiscal operation is limited to the central bank's discretionary policy to ease the pressure on interest rate. Bond financed deficits may however, generate a wealth impact in the private sector financial portfolio and may increase the aggregate demand and price levels in the economy. Different schools of thought, however stand divided on this issue. In the Keynesian framework, bond financed deficits are supposed to generate strong wealth impacts, which is contested by both neoclassical and Ricardian full foresight models [See for example a debate on this issue by Bernheim (1989) and Barro (1989)]. However, when the deficit is financed by borrowing from the central bank the impact on prices is felt more quickly and directly. The inflationary outcome of deficit shifts the relative prices in favour of imports and away from domestic goods and exports resulting in an increase in net imports.

The model focuses mainly on the income and price channels of transmission and has the following major features. Determination of fiscal deficit and its financing constitutes the central feature of the model. The evolution of fiscal deficit is a process of determination of government revenues and expenditures, a large part of the latter being determined by policy considerations. The model follows a disaggregated approach to the determination of government revenue from taxes, property income and savings of departmental and non-departmental enterprises. While government consumption and interest payments are endogenously determined, transfer payments and public investments are assumed to be policy determined. Fiscal deficit is financed by increase in domestic credit i.e. by borrowing from commercial banks and Reserve Bank, or borrowing from non-bank-

ing domestic sources or by way of net foreign borrowings. Among all the borrowing sources, some of which are endogenously determined in the model, Reserve Bank credit to the government forms the vital link between the fiscal and monetary sector.

The relation between fiscal deficit, money and output forms the second important transmission channel in the model. An increase in fiscal deficit leads to monetary expansion, but to the extent that deficit is due to an increase in public investment, the long run impact on prices is expected to be lower than the case when deficit is incurred for current expenditure. Since the output function is augmented with a demand variable, the model recognises the short run expansionary impact of government expenditure on output[2]. Further, the model highlights the link between credit and output by introducing real money stock as an argument in the non-agricultural output function.

The interaction between fiscal deficit, private consumption and investment forms the third vital link in the model. A tax-cut or expenditure induced deficit increases the private disposable income, leading to higher consumption in the current period. The model assumes the short-sighted response of private sector to the government deficit, and therefore, rules out the tax-discounting hypothesis central to the Ricardian Equivalence proposition. The empirical estimates of the private consumption function test for direct 'crowding out' impact of government consumption on private consumption. As is evident in the case of many developing countries, government consumption is found to be positively influencing private consumption in India, implying perhaps the complementary relation between the two.

Determination of investment level in the economy forms the fourth major aspect of the model. A single investment function for the entire economy may not accurately account for the behavioural characteristics of investment in different sectors. The model introduces disaggregation at a broad level, *viz.*, agriculture and non-agriculture, in order to capture the determinants of investment in these two sectors. Investment may come from private or public

sector, the latter is largely a policy variable and hence treated exogenous in the model. Private non-agricultural investment function is specified through the accelerator framework, augmented with a long run profit variable, interest rate and a variable representing credit availability conditions. Private agriculture investment, on the other hand, is dependent on the income originating from this sector and the government investment in agriculture. Gross investments in these two sectors, along with the depreciation requirement determine the level of capital stock, which in turn determines the output level in the economy.

The import demand is determined by an aggregate demand variable which is defined to include private absorption, government expenditure and exports. This constitutes the fifth important feature of the model. Export demand in the model is a function of export price relative to world price and the level of world income. Export price is expressed as an inverted export supply function which is postulated to depend on domestic cost and demand conditions. The endogenously determined levels of export and import of goods and services together with net external interest payments and international transfers (net) generate the current account balance in the model. An important feature of the model is that the current account balance, apart from being determined endogenously, also influences the stock of external debt and interest payments with a self-generating feed-back effect.

The model, as it emerges, combines the features of both the absorption and monetary approach to external adjustment. By bringing out the nexus between money, output and prices it places emphasis on the role of deficit and money in the real economy. The model is estimated using the data for the sample period 1971-72 to 1993-94. The sector-wise detailed feature of the model along with the empirical estimates of the parameters are discussed in the following section.

## Section III
## Specification of the Model and the Estimated Parameters

### 1. Fiscal Operations:

Given the objectives of the current exercise, government sector constitutes the most important subsector in the model. Consistent with the national income identity, linking fiscal deficit to the current account of balance of payments, the analysis here is based on the consolidated public sector, which in the Indian context comprises general government (Centre, States and Union Territories) and their departmental and non-departmental enterprises. It may be noted that the concept of fiscal deficit used in the budget documents mainly concerns with the measurement of borrowing requirement of the government and may be ill-suited to study the aggregate demand impact of deficit (Blejer and Cheasty, 1991). The budgetary definition of gross fiscal deficit (revenue receipts *minus* total expenditure including net lending) generally overstates the demand impact of deficit. A more meaningful analysis of government expenditure should be based on its economic classification into consumption, transfer payments, and investment, which can be combined with private sector absorption to study the domestic demand impact of fiscal deficit. Similarly, the revenue side of the budget also needs to be redefined to include the savings of the departmental and non-departmental enterprises of the government. Therefore, some adjustment in the published data of fiscal deficit becomes essential to put them to economically more meaningful analysis. In view of this, data on the government sector for the study are drawn from the National Account Statistics which presents the economic and purpose-wise classification of government expenditure. In this paper all nominal variables are denoted by higher case letters and real variables by lower case letters while change between two time points is indicated by the sign $\Delta$.

Following budget constraint of the public sector provides the starting point of the analysis.

$$GXP - TR = \Delta BCG + \Delta RCG + \Delta FICG + DNB + EB + MISCR \quad ...(2)$$

where,

$$TR = DT + DIT + TM + NTX + SE \quad ...(2a)$$
$$GXP = CON + TRP + PCF \quad ...(2b)$$

Equation (2) shows that fiscal deficit, i.e., the excess of public sector expenditure (GXP) over current revenue (TR) is financed by increase in domestic credit to government i.e. by credit from commercial banks (BCG) and from Reserve Bank (RCG); borrowing from other sources, including financial institutions (FICG) and domestic non-banking institutions (DNB); external loans (EB) and miscellaneous capital receipts (MISCR). Total revenue of public sector comprises revenue from direct taxes (DT), domestic indirect taxes (DIT) and import taxes (TM) and non-tax revenue (NTX), consisting of income from property and entrepreneurship and miscellaneous current receipts of administrative departments and the gross savings (SE) of the departmental and non-departmental enterprises in the public sector. Expenditure in the public sector is incurred in the form of government consumption (CON), transfer payments (TRP) including interest payments (IP) and gross public capital formation (PCF).

### i. Government Revenues

On the revenue side, tax and non-tax revenue functions are specified through a partial adjustment framework, with the assumption that at any point of time the actual tax revenue partially adjusts to the long run desired level. As revenues are targeted in nominal terms, both tax and non-tax revenue equations are estimated at their current price levels.

Revenue from direct taxes are posited to be a function of real income originating from non-agriculture sector (at factor cost) and domestic price level. Inflation is expected to increase tax revenue, since nominal tax collections should rise at least proportionally with prices. However, if lags in tax collection are long, revenue from direct taxes may not be elastic to inflation and real tax revenue may fall with inflation (Tanzi, 1977). On the other hand, nominal direct tax revenue is expected to rise more than proportionately, if

tax brackets are not indexed to inflation. The net effect of inflation on tax revenue will therefore depend on the relative strengths of both the factors. The following equation provides the estimates of relative income and price elasticities of direct taxes in the partial adjustment framework.

$$\begin{aligned} \text{Ln DT} = & -2.171 + 0.316 \text{ Ln ynar} + 0.305 \text{ Ln P} \\ & (-1.444) \quad (1.042) \qquad\quad (2.549) \\ & + 0.660 \text{ Ln DT}_{(-1)} + 0.154 \text{ DDT} \qquad\quad \ldots(3) \\ & \quad (4.749) \qquad\quad (5.602) \end{aligned}$$

$\bar{R}^2 = 0.99$, h = 0.12, SEE = 0.06, Mean = 3.99

Where 'ynar' is real GDP at factor cost originating from non-agricultural sector, 'P' is wholesale price index and 'DDT' is a dummy. The figures in the brackets are the respective 't' values of the regression coefficients. The long run elasticity of direct tax revenue with respect to real non-agricultural income works out to near unity; during the period 1971-72 to 1993-94. The price elasticity of direct tax revenue is about 0.3 in the short run and 0.9 in the long run. The equation was estimated with a dummy to account for the significant changes in tax structure that has taken place since 1991-92 following the introduction of a comprehensive tax reform programme. As is expected, the dummy has a positive sign in the equation.

Indirect taxes are divided into two parts, domestic indirect taxes (DIT) and import taxes (TM). While the former is a function of real income and the price level, the latter is determined by the average import duty rate and the volume of import. The following two equations provide the estimates of domestic and trade taxes.

$$\begin{aligned} \text{Ln DIT} = & -2.496 + 0.347 \text{ Ln y} + 0.369 \text{ Ln P} \\ & (-2.427) \quad (2.073) \qquad\quad (2.974) \\ & + 0.682 \text{ Ln DIT}_{(-1)} - 0.065 \text{ DDIT} \qquad\quad \ldots(4) \\ & \quad (6.469) \qquad\quad (-4.08) \end{aligned}$$

$\bar{R}^2 = 0.99$, h = -1.33, SEE = 0.03, Mean = 5.27

$$TM = MR \times (impt \times PIMP) \qquad ...(5)$$

Where 'y' is real income at factor cost, 'DDIT' is a dummy, 'MR' is average import duty rate, 'impt' is real imports in Rupees, and PIMP is price of import. The long run elasticity of domestic indirect tax revenue to real income is placed at 1.09. The price elasticity of domestic indirect tax revenue is estimated at 1.16, showing a more than proportional adjustment between inflation rate and the increase in indirect tax revenue. This should be expected, since most of the taxes on goods and services are levied at *ad valorem* rates, making the tax base elastic to inflation. The equation included a dummy to represent the significant changes introduced in the structure of union excise duties in the post-reform period, which had a short term negative effect on revenue. Import tax revenue was specified as an identity linking the revenue to the average import duty rate, the volume of real imports and import prices.

On the non-tax revenue side, government property and entrepreneurial income together with miscellaneous current revenues are related to the level of economic activity, proxied by GDP at current market prices (YM). Gross savings of the departmental and non-departmental public enterprises which represent the net result of their commercial operations are assumed to be determined outside the system. It may be mentioned that the classification and definition of government property income has undergone frequent revisions due to, among others, the changing depreciation norms. In order to smooth out these breaks in data points a shift dummy (DNTX) has been introduced in the non-tax revenue equation. The estimates of the parameters are as follows.

$$NTX = \underset{(-0.679)}{-1.435} + \underset{(26.449)}{0.016}\ YM - \underset{(-4.109)}{19.008}\ DNTX \qquad ...(6)$$

$\bar{R}^2 = 0.97$, DW = 1.44, SEE = 6.17, Mean = 40.72

### ii. Government Expenditure

Of the four major categories of expenditure considered in the model, *viz.*, consumption, interest payment, transfer payments and public investment, the latter two are treated exogenous in the system. Transfer payments consisting of subsidies and pension payments and other current transfers are influenced by a set of social and economic factors. They are frequently used as means to promote certain distributional objectives. In developing countries, public investment outlay subsumes several policy objectives and at times could be a residual item in the budget given the revenue constraints and expenditure commitments in the current account of the budget. It could, however, be argued that in the case where deficit is monetised to a large extent, the financing constraints may not seem to be a binding constraint on the level of investment outlay in the budget.

Real consumption expenditure of the government is related to economic activity which is proxied by the real GDP at market prices. Government consumption function is specified in real terms to underline the fact that government desires to maintain a real level of consumption in each period. The estimated equation in the partial adjustment framework is as follows.

$$\underset{\quad}{\text{Ln con}} = \underset{(-3.984)}{-2.287} + \underset{(4.016)}{0.753}\ \text{Ln ym} + \underset{(3.642)}{0.489}\ \text{Ln con}_{(-1)} \quad ...(7)$$

$\bar{R}^2 = 0.98$, h = 3.87, SEE = 0.05, Mean = 5.17

The short run and long run income elasticities of government consumption expenditure are placed at 0.71 and 1.47, respectively, during the sample period, which show the fast pace at which government real consumption responds to changes in economic activity. Total interest payment is divided into two parts *viz.*, interest payment on internal debt and that on external debt. Gross internal and external interest payments are related to the respective outstanding debts at the beginning of the year and the average interest rates.

$$IPI = I_d \times IDBT_{(-1)} \quad ...(8)$$

$$IPX^g = I^g_x \times XDBT^g_{(-1)} \quad ...(9)$$

Where 'IPI' and '$IPX^g$' are internal and external interest payments of the government, respectively, '$I_d$' and '$I^g_x$' are average interest rates on internal and external debts, and 'IDBT' and '$XDBT^g$' are the outstanding internal and external government debt.

Total outstanding debt (TDBT) is defined as :

$$TDBT = TDBT_{(-1)} + \Delta TDBT \quad ...(10)$$

The change in outstanding debt ($\Delta$TDBT) in any given year should ideally equal to the fiscal deficit in that year. However, since the published data on incremental debt do not accurately agree with the fiscal deficit (FD), the following functional form was used to estimate the incremental debt.

$$Ln\ \Delta TDBT = -0.175 + 1.077\ Ln\ FD - 1.549\ DDBT \quad ...(11)$$
$$(-0.603)\quad (18.649)\qquad (-4.169)$$

$$\bar{R}^2 = 0.97, \quad DW = 2.24, \quad SEE = 0.35, \quad Mean = 6.88$$

Outstanding external debt of the government is determined by the flow of foreign borrowing ($EB_g$) during the year together with the outstanding debt of the previous year, where $EB_g$ is assumed as a fraction E of the change in total debt. The difference between the total debt and the external debt gives outstanding internal debt. The following identities explain the determination of two different components of government debt.

$$XDBT^g = XDBT^g_{(-1)} + EB^g + VLC \quad ...(12)$$

$$EB^g = E \times \Delta TDBT \quad ...(13)$$

$$IDBT = TDBT - XDBT^g \quad ...(14)$$

### iii. Government Borrowing

Financing of fiscal deficit takes place through following major ways:

(1) increase in commercial bank credit to government (ΔBCG);

(2) increase in financial institutions' credit to government (ΔFICG) mainly through their investment in government securities;

(3) borrowing from domestic non-banking sources, namely from households and others in the form of small savings, provident funds and special deposits;

(4) increase in other domestic miscellaneous capital receipts which represents net changes in deposit account, reserve funds, etc.

(5) borrowing from external sources ($EB^g$); and

(6) increase in net RBI credit to the government, which essentially goes to meet the shortfall between the fiscal deficit and the borrowing from all other sources.

Commercial banks' credit to the government is influenced by two major factors, growth in their aggregate deposits and the statutory liquidity ratio. The following equation was considered for estimating the incremental commercial banks' credit to the government.

$$\begin{aligned} \text{Ln } \Delta BCG = {} & -3.307 + 1.331 \text{ Ln } \Delta DEP \\ & (-6.516) \quad (13.924) \\ & + 0.385\ \Delta WSLR + 1.075\ DBCG \qquad \ldots(15) \\ & (2.287) \qquad\quad (4.131) \end{aligned}$$

$\bar{R}^2 = 0.93$ DW = 2.09, SEE = 0.35, Mean = 3.06

The elasticity of incremental bank credit to the government with respect to incremental deposits (ΔDEP) of commercial banks is estimated to be more than unity. Since the SLR requirements changed frequently even within a financial year, a weighted average

rate was used to estimate the sensitivity of banks' investment in government paper to SLR changes. Here, the SLR variable represents the relevant ratio weighted by the number of days it remained in force during a year. The equation was estimated with a dummy (DBCG) to account for sharp variation in bank credit to government in 1975-76 and 1977-78. Incremental deposits of commercial banks was linearly related to increase in $M_3$.

$$\Delta DEP = -1.118 + 0.814\ \Delta M_3 + 8.226\ DDEP \qquad ...(16)$$
$$(-0.591)\ (111.228)\quad (1.689)$$

$\bar{R}^2 = 0.99$, DW = 2.12, SEE = 9.32, Mean = 252.57

Investment of financial institutions in government securities depends on the growth of their investible resources. Since the regression equation did not show satisfactory statistical relation between the two, this component of borrowing was assumed exogenous in the model. The following equation provided the estimates of domestic non-bank borrowing, which is related to the nominal income (Y) and its own past values. Apart from the level of economic activity, a significant factor explaining a large increase in the government borrowing through small savings and provident funds relates to the tax benefits offered to their investors. Studies have estimated that effective rate of return on some of the small savings instruments after taking into account the tax benefits was as high as 34 per cent in 1990-91 (Bagchi and Nayak, 1993). However, a safisfactory index of effective return on small savings on a time series basis is not available for evaluating the impact of this variable on government borrowing from the household sector.

$$Ln\ DNB = -7.151 + 1.449\ Ln\ Y + 0.498\ Ln\ DDNB \qquad ...(17)$$
$$(-14.144)\ (20.438)\quad (8.860)$$

$\bar{R}^2 = 0.97$, DW = 0.53, SEE = 0.21, Mean = 3.66

The estimated income elasticity of small savings and provident fund receipts work out to 1.45, reflecting the combined influence of relatively faster growth of household savings in the 1970s and 1980s and the household's preference for these securities on account of their promise of high post-tax return.

The remaining component of government borrowing, i.e., miscellaneous capital receipt is treated exogenous in the model. This leaves the Reserve Bank credit to the government which is obtained as a residual finance after exhausting the borrowings from all other sources. The following identity links the change in Reserve Bank credit to the government to fiscal deficit and borrowing from other sources.

$$\Delta RCG = FD - \Delta BCG - \Delta FICG - DNB - EB^{g} - MISCR \quad ...(18)$$

## 2. Demand for Money and Price Determination

Price equation in the model takes the form of an inverted money demand function. In general form, the demand for real money balances could be postulated to take the following functional specification.

$$Ln\ (M/P) = \alpha_0 + \alpha_1\ Ln\ y - \alpha_2 i - \alpha_3\ \pi^e \quad ...(19)$$

Where the real money balance is expressed as a function of the real income (y), interest rate (i) and the inflation expectation ($\pi^e$). The signs of the coefficients in the equation are consistent with the theoretical expectation regarding the impact of various economic forces on demand for real money balances. The model includes two opportunity cost variables; namely interest rate (i) and inflation rate ($\pi$) representing the cost of holding money against other financial assets and goods, respectively. Inverting this function, we get an expression for price as :

$$Ln\ P = -\ \alpha_0 - \alpha_1\ Ln\ y + \alpha_2 i + \alpha_3 \pi^e + Ln\ M \quad ...(19a)$$

According to the above specification price situation is essentially influenced by the monetary conditions, growth of real income and the peoples' desire to adjust their real money balances in response to changes in interest rate and inflation. Inflation rate in the model should be truely represented by its expected value. Since the price equation is specified in a partial adjustment framework, it is expected that the lagged price level would capture some of the ef-

fects of the expected inflation. The empirical version of the price equation is as follows :

$$\begin{aligned} \text{Ln } P = {} & 2.407 - 0.387 \text{ Ln } y + 0.253 \text{ Ln } M_3 + 0.738 \text{ Ln } P_{(-1)} \\ & (2.185) \quad (-1.877) \qquad (3.524) \qquad (7.797) \\ & + 0.073 \text{ DP1} + 0.153 \text{ DP2} \qquad \ldots(20) \\ & (2.185) \qquad (5.892) \end{aligned}$$

$\bar{R}^2 = 0.99$, $h = -0.93$, SEE = 0.03, Mean = 4.74

The general price level (P) refers to the index of wholesale prices. The lagged price variable in the model incorporates the lagged effect of output and money supply on the current year's price level. Interest rate had to be dropped from the model due to its weak statistical significance. The equation includes two dummies; 'DP1' represents the dummy for high inflation rates in 1973-74 and 1974-75 following the first oil shock and 'DP2' as the dummy for 1980-81 to account for the lag impact of second oil shock. The short run elasticity of price with respect to real income works out to -0.39 and that to '$M_3$' to 0.25. As should be expected in the case of an inverted money demand function, long run elasticity of price to money supply works out to near unity (0.97). The corresponding long run elasticity to real income is placed at 1.48. The implicit income elasticity of money demand is placed at 1.53 for the sample period 1971-72 to 1993-94.

## 3. Interest Rate

Interest rate constitutes an important transmission channel of macro-economic adjustment process, depending on how free and open is the financial market of an economy. In the case of developing countries, with relatively regulated and close financial market this transmission belt is expected to be weak, particularly in relation to the portfolio behaviour of the households which constitutes a major channel of adjustment. Even in the case of these economies, interest rate, while being administered, can have significant influence on the investment decision in the economy and as a result, can influence the level of aggregate demand and output.

In this model, the role of interest rate is addressed in the context of its impact on the cost of credit and the level of aggregate demand in the economy. The objective is to identify the proximate determinants of interest rate and then establish a link between the borrowing and lending rates of commercial bank. While it can be argued that in the Indian context, until recently, interest rate did not play an equilibriating role in the money market, it is also important to recognise that the policy responses by way of interest rate changes in the past were not completely out of place with developments in the money market and domestic price conditions. Keeping in view the current evolving stage of financial markets in India, it is essential to gather some idea about the determinants of interest rate in order to account for its impact on the investment decisions in the economy. In the developing country context interest rate determination has been addressed in a variety of ways, keeping in view the underlying structure and characteristics of the financial economy in question and the extent of its integration with the global financial market. Given the fact that for most of the sample period, Indian economy operated under a relatively high degree of capital control, interest rate was mostly determined by the domestic economic conditions. Accordingly, the theoretical framework considered in the model draws on the money market equilibrium conditions and the Fisher's hypothesis of determination of nominal interest rate. The approach set out below has been extensively discussed in Edwards and Khan (1985).

According to the standard Fisher hypothesis, nominal interest rate (i) is given by

$$i_t = r_t + \pi^e_t \qquad ...(21)$$

where 'r' is real interest rate and '$\pi^e$' is expected inflation rate. The real interest rate in any period is postulated to evolve as a deviation from its long run equilibrium level, this deviation being brought about by the excess or shortage of money supply over money demand.

$$r = \delta - \mu\ EMS_t + w_t \qquad ...(22)$$

Where 'δ' is long run equilibrium real interest rate, 'EMS' represents excess supply of money and '$w_t$' is a white noise residual. The excess supply of money is given by the difference between the actual stock of and the demand for real money balances (m)

$$EMS_t = Ln\ m_t - Ln\ m^d_t \qquad ...(23)$$

As in equation (19) the money demand function is given by

$$Ln\ m^d_t = \alpha_0 + \alpha_1\ Ln\ y_t - \alpha_2\ (\delta+\pi^e_t) - \alpha_3\pi^e_t \qquad ...(24)$$

which has two opportunity cost variables in $(\delta + \pi^e_t)$ and $\pi^e_t$. Assuming a stock adjustment process for real money stock we get,

$$Ln\ m_t = \beta(Ln\ m^d_t - Ln\ m_{t-1}) \qquad ...(25)$$

Where $\Delta Ln\ m_t = Ln\ m_t - Ln\ m_{t-1}$ and $\beta$ is the coefficient of adjustment such that, $0 \leq \beta \leq 1$. Equation (25) can be simplified as,

$$Ln\ m_t = \beta Ln\ m^d_t + (1-\beta)\ Ln\ m_{t-1} \qquad ...(26)$$

Combining (23) and (26) we get,

$$EMS_t = (1-\beta)\ (Ln\ m_{t-1} - Ln\ m^d_t) \qquad ...(27)$$

which together with (21), (22) and (24) yield the following estimatable version of the reduced form equation for nominal interest rate :

$$i_t = \Phi_0 + \Phi_1\ Ln\ y_t + \Phi_2\ Ln\ m_{t-1} + \Phi_3\pi^e_t + w_t \qquad ...(28)$$

Where $\Phi_0 = \delta + \mu(1-\beta)(\alpha_0 - \alpha_2\delta)$

$$\Phi_1 = \mu\ (1-\beta)\alpha_1$$
$$\Phi_2 = -\mu\ (1-\beta)$$
$$\Phi_0 = [1-\mu\ (1-\beta)(\alpha_2 + \alpha_3)]$$

Interest rate in the empirical model was represented by the one-to-three year deposit rate of banks (IB) and the variable of expected inflation was substituted by actual inflation. The estimated parameters of equation (28) are presented below :

$$IB = \underset{(-2.592)}{-42.909} + \underset{(2.546)}{10.902}\ \text{Ln}\ y \qquad \ldots(28a)$$

$$- \underset{(-1.863)}{4.332}\ \text{Ln}\ m_{3(-1)} + \underset{(2.116)}{0.068}\ [(P - P_{(-1)})/P_{(-1)}] \times 100$$

$\bar{R}^2 = 0.65$, DW = 1.77, SEE = 0.70, Mean = 8.89

The above equation implies that lagged real money supply exerts a downward influence on the nominal interest rate while real income tends to increase it. Inflation and interest rate are seen to be positively related though not in a very significant way. Given the estimates of deposit rate from equation (28a) the lending rate of commercial banks is estimated by adding to the deposit rate the intermediating cost, which for simplicity is assumed exogenous in the model and is given by the observed difference betwen the one-to-three year deposit rate and the weighted average lending rate of commercial banks.[3]

$$WLR = IB + OPC$$

Where WLR is weighted average lending rate of commercial banks and OPC is intermediating or operating cost of commercial banks.

## 4. Money Supply Determination

The determination of money supply is a process of determination of the sources of variation in reserve money and the money multiplier. Among the various sources affecting reserve money, the major component *viz.*, the Reserve Bank credit to the government is determined within the model. The objective here is to bring out the nexus between money supply and fiscal deficit as the primary channel of monetary expansion. As mentioned earlier, Reserve Bank credit to the government is endogenously determined in the model

from the financing side of deficit. Historically, this was the major source of growth of reserve money during much of the sample period under study. The supply of broad money ($M_3$) is related to reserve money by the following equation, which gives an estimated parameter for the money multiplier.

$$M_3 = -47.278 + 3.192\ RM \qquad ...(29)$$
$$(-2.715)\ (100.985)$$

$$\bar{R}^2 = 0.99,\ DW = 1.61,\ SEE = 56.93,\ Mean = 1239.48$$

The estimated money multiplier is placed at 3.19 for the sample period 1971-72 to 1993-94. Ideally the money multiplier should be functionally related to behavioural factors, such as ratio of currency to deposits, and a policy variable, i.e. the cash reserve ratio. It has also been contended that money multiplier will depend on demand for credit and hence on output, since the degree at which a given quantum of reserve money will translate into money supply will depend on the credit demand in the economy at that point of time. While this position is theoretically valid, it is to be noted that in the Indian context with an administered structure of interest rate until recently and varying rates of interest for different activities, demand for credit was not a binding constraint. Interest rates charged on some activities were below the market rate and demand for credit at those rates of interest was highly elastic. In fact, the Indian commercial banks do not voluntarily hold any excess reserves and whatever excess reserves they may be holding are involuntary due to inadequate facilities for quick transmission of funds from far flung branches (Rangarajan and Arif, 1990). Further, for a proper estimation of the relationship between money supply and reserve money, at the minimum, it is necessary to adjust the series on reserve money for changes in the cash reserve ratio. In fact, such an adjusted series is found to give a better explanation of changes in money stock particularly when quarterly data are used (Rangarajan and Singh, 1984). However, since we are dealing with annual time series, adjustments have not been made for changes in cash reserve ratio.

## 5. Private Sector Behaviour

Central to the argument of fiscal dimension of the balance of payments problem is the relation between the fiscal deficit and private spending behaviour. Both in the theoretical and empirical literature, there has been a considerable degree of disagreement on modelling the private sector's response to changes in fiscal deficit and its financing composition. In the conventional Keynesian framework, an increase in government deficit, whether caused by a cut in taxes or by increased expenditure, will boost private spending by increasing disposable income. Since consumers are assumed to be myopic and liquidity constrained, the forward looking behaviour goes out of the Keynesian analysis and what become relevant are the current income and current consumption and thus, current taxation and deficit. The finite horizon models in the typical tradition of life cycle hypothesis state that temporary deficits will have minimum effects on private spending, while deficits brought about by permanent tax cuts will significantly stimulate consumer spending. Both these theories are contradicted by Ricardian equivalence hypothesis, which under the assumptions of infinite planning horizon and perfect capital markets holds that government deficit will be fully neutralised by opposing economic behaviour of the private sector (Barro, 1974). In other words, government deficit by increasing the probability of a future tax rise will result in equivalent reduction of private consumption. Consequently, deficit does not reduce national saving and has no implications for external current account balance.

The mainstream models on fiscal approach to balance of payments follow the Keynesian tradition in modelling private sector response to public deficits, wherein private consumption and investment are lumped together in a single private expenditure function with disposable income as the main explanatory variable (for example, Cambridge Economic Policy Group model, 1976). There are, however, two major limitations of this approach. First, it does not make a distinction between consumption and investment demands of the private sector. These two parts of private absorption may exhibit different behavioural relations with changes

in economic activity. Secondly, this approach assumes full exogeneity of private sector in the determination of the current account balance, hence changes in the latter are explained by changes in the public sector financial balances. In reality, however, private consumption apart from being determined by disposable income can be directly influenced by fiscal policy changes, which brings the 'crowding out' phenomenon into the picture.

### (i) Private Consumption

In the light of the above discussion the private absorption function considered here draws a distinction between the consumption and investment demand. Private real consumption is a function of its real disposable income. While the Ricardian position with regard to government deficit may not seem to be providing a plausible explanation for the intertemporal consumption behaviour of the private sector in developing countries, it has been, however, argued that government consumption may have direct implications for private consumption [Easterly and Schmidt-Hebbel (1993) and Mohanty (1992)]. In order to account for the possible 'crowding out/in' impact, the private consumption function considered here is augmented with government consumption as an argument. The effect of inflation on consumption has received considerable attention in developing countries. It is expected that in a low income country inflation may lead to reduction in saving levels because of the low resistance of poor consumers to cuts in real consumption. Inflation can also depress savings by encouraging flight from currency and bank deposits to consumer durables (under financial repression). Anticipated inflation is expected to stimulate present consumption while surprise or unanticipated inflation may not have a strong impact on consumption. The empirical evidence in the context of developing countries including India show that real consumption tends to increase with rise in prices, whether anticipated or not (Lahari 1989). The following equation provides the empirical estimates of various influences on private real consumption expenditure.

$$\begin{aligned} \text{Ln pc} = {} & 1.686 + 0.615 \text{ Ln pyd} + 0.107 \text{ Ln con} \\ & (3.468) \quad (5.416) \qquad\quad (1.855) \\ & + 0.072 \text{ Ln P} \\ & (1.546) \end{aligned} \qquad \ldots(30)$$

$\bar{R}^2 = 0.99$, DW = 1.85, SEE = 0.02, Mean = 7.03

The elasticity of private consumption with respect to disposable income is estimated at 0.62. The coefficient of government consumption is positive though small, indicating that private consumption tends to increase with government consumption. This is probably because government consumption expenditure in certain areas may be crowding in private consumption due to their complementary nature. Price level has a positive impact on the real consumption, although the effect works out to be small.

**(ii) Private Investment**

Private investment behaviour is modelled in two equations relating to agriculture and non-agriculture investment. The following equation specifies the private real agricultural investment function.

$$\begin{aligned} \text{Ln piag} = {} & -3.053 + 0.956 \text{ Ln yar}_{(-1)} + 0.210 \text{ Ln pcfag} \\ & (-4.133) \quad (8.261) \qquad\quad (2.109) \\ & - 0.167 \text{ dpiag1} + 0.165 \text{ dpiag2} \\ & (-2.603) \qquad\quad (2.714) \end{aligned} \qquad \ldots(31)$$

$\bar{R}^2 = 0.80$, DW = 1.03, SEE = 0.09, Mean = 3.43

Where 'piag' is private gross agricultural investment in real terms, 'yar' is real GDP originating from agriculture, 'pcfag' is real gross public investment in agriculture and 'dpiag1' and 'dpiag2' are two dummies to account for large fluctuations in investment in some years. Private agricultural investment is found to be significantly influenced by the lagged agricultural income, with an elasticity of near unity. Government investment in agriculture has a positive impact on private agricultural investment which reinforces

the contention expressed in several studies in this regard [for example, Rath (1989), Shetty (1990), and Krishnamurty *et al* (1997)]. This should be expected as government provides major infrastructural inputs such as irrigation and research and development in agriculture, which form the critical base for private capital formation.

Real private investment function for the non-agricultural sector is specified through the accelerator framework, where investment is related to the expected increase in demand for output. Following an adaptive expectation framework, the investment equation is expressed in terms of the current year's change in income and the investment level of past one period. In the developing countries, public investment constitutes a key determinant of the private investment. Public investment, especially in infrastructure, increases the long run marginal productivity of private capital and thereby helps promote investment in private sector (Aschauer, 1989). Further, there could be an output linkage where public capital stock raises the demand for private output. On the other hand, public investment may displace private investment in some sectors by depriving the private sector of scarce physical and financial resources. This phenomenon of what is called 'financial crowding out' is generally believed to be strong in developing countries, where the public sector enjoys preferential borrowing treatment over the private sector. Under this situation the actual level of private investment may fall short of its desired level on account of the binding borrowing constraint in the domestic and external credit markets. In the developing country context, including India, several models have recognised this dual and conflicting role of public investment in promoting aggregate capital stock [see Sunderarajan and Thakur (1980), Krishnamurty *et al* (1985), Blejer and Khan (1984) and Pradhan *et al* (1988)]. In most of the models, in the Indian context, crowding-out phenomenon has emerged stronger than the complementarity effect. The present model tests for the competitive impact of public investment on private investment in industry and tertiary sector, by including a financial variable in the private non-agricultural investment function, represented by banking sector's credit to commercial sector and net capital inflow from abroad.

$$\text{pinag} = \underset{(1.936)}{30.801} + \underset{(2.621)}{0.253}\ \Delta y + \underset{(1.692)}{0.372}\ (\Delta \text{bcp} + \text{capb})$$

$$- \underset{(-2.168)}{1.420}\ \text{wlr} + \underset{(2.107)}{0.486}\ \text{pinag}_{(-1)} \qquad \ldots(32)$$

$\bar{R}^2 = 0.83$, h = -1.035, SEE = 22.03, Mean = 146.57

Where 'pinag' is real investment of private sector in the non-agriculture sector, 'bcp' is real bank credit to private sector, 'capb' is the capital account balance (representing the real capital inflow from abroad) in the balance of payments accounts deflated by wholesale price index and 'wlr' is weighted average real lending rate of commercial banks.[4]

The OLS test statistics show that the equation has good explanatory power and is free from autocorrelation problem. The impact of marginal change in current year's output on private non-agricultural investment is estimated at 0.25 in the short run and 0.49 in the long run. An increase in bank credit to the government for financing its investment is expected to partly 'crowd out' private investment in the same year, the long run impact works out to 0.72. The negative impact of cost of capital on private investment is also confirmed by the coefficient of 'wlr'.

## 6. Real Output

The output function is specified in two equations *viz.*, agricultural and non-agricultural output in order to bring out the sectoral characteristics of output generation in the economy. Agricultural output is related to rainfall index (RAIN), gross cropped area (AREA) and real net capital stock in agriculture (KAGR).

$$\text{Ln yar} = \underset{(-3.968)}{-7.132} + \underset{(2.139)}{0.169}\ \text{Ln RAIN} + \underset{(3.425)}{0.989}\ \text{Ln AREA}$$

$$+ \underset{(6.421)}{1.231}\ \text{Ln kagr}_{(-1)} \qquad \ldots(33)$$

$\bar{R}^2 = 0.77$, DW = 1.80, SEE = 0.04, Mean = 6.25

Agriculture output is significantly influenced by the initial level of real net capital stock in agriculture. The elasticity of output to capital stock is estimated at 1.25. Output originating from non-agriculture sector is estimated by a production function, featuring an aggregate demand variable (add), real net capital stock in this sector (knagr) and real money stock ($m_3$). In the short run, output is expected to respond to demand conditions as firms will use up their stock of inventories and utilise their existing capacity more intensively. This impact is intended to be captured by a demand variable, represented by aggregate demand for domestically produced goods (add) and is defined to include government expenditure, private absorption, exports and imports. This variable brings out the interaction between the non-agriculture sector with the rest of the sectors such as agriculture and trade sector. An increase in agricultural output will generate demand for non-agricultural output as also facilitate the supply of essential raw materials for industry [Rangarajan (1982)]. While exports will have a positive impact on the demand for industrial output raising its production, imports will act as a leakage for the domestic output. Non-agricultural output function also includes the stock of real money balance as an explanatory variable to proxy bank credit to real sector.

$$\underset{\quad}{\text{Ln ynar}} = \underset{(-12.232)}{-2.098} + \underset{(7.936)}{0.488}\ \text{Ln add} + \underset{(12.534)}{0.627}\ \text{Ln knagr}_{(-1)}$$

$$+ \underset{(2.058)}{0.045}\ \text{Ln } m_3 \qquad \ldots(34)$$

$\bar{R}^2 = 0.99$, DW = 1.93, SEE = 0.001, Mean = 6.82

All variables included in the equation emerged statistically significant. The elasticity of non-agricultural output to demand is estimated at 0.49 and that with respect to lagged capital stock at 0.63. The stock of real money balance has a positive influence on output. This reinforces the credit view argument of money supply in a developing economy.

## 7. External Sector

External sector in the model is divided into three major blocks *viz;* export and import of goods and services, interest receipts and payments and net international transfers including non-interest investment income. Determination of exports and imports in the model is guided by the consideration that fiscal deficit affects the domestic demand and price conditions, leading to changes in the relative prices in the external sector. Demand for real export of goods and services is postulated as a function of world income and exports price relative to world price. Real exports are positively related to world income and negatively to export price relative to world price. Implicit in this specification is the assumption that as world price of exports goes up world demand would shift in favour of India's exports given her export price. The export demand equation estimated through a partial adjustment process with one dummy to account for unexplained variation in services, which are less price sensitive, is as under.

$$\begin{aligned} \text{Ln expt\$} = {} & -1.263 + 0.574\ \text{Ln wyr} - 0.319\ (\text{pexp\$/wpexp}) \\ & (-1.469) \quad (2.417) \qquad\quad (-3.343) \\ & + 0.569\ \text{Ln expt\$}_{(-1)} + 0.102\ \text{dexpt\$} \qquad \ldots(35) \\ & (4.568) \qquad\quad (5.541) \end{aligned}$$

$$\bar{R}^2 = 0.99, \quad h = -0.87, \quad SEE = 0.04, \quad Mean = 2.413$$

Where 'expt$' is export of goods and services at constant dollar price (dollar value of merchandise and services exports deflated by dollar price of exports), 'wyr' is index of world real income, 'pexp$' is index of India's export price (expressed as unit value index of exports (UVIX) deflated by an index of exchange rate) and 'wpexp' is the world export price (unit value index of world exports). The elasticity of export of goods and services to world income is estimated at 0.57 in the short run and 1.33 in the long run and with respect to relative export prices at 0.32 in the short run and 0.74 in the long run.

The unit value index of exports (UVIX) is specified as an inverted export supply function. Theoretically, export supply is related to domestic economic activity proxied by real income, and export price relative to domestic price to measure the impact of relative profitability of export business *vis-a-vis* domestic sales. Therefore, the export supply function is:

$$\text{Ln expt}^s = \theta_1 + \theta_2 \text{ Ln y} + \theta_3 \text{ Ln (UVIX/P)} \qquad ...(36)$$

Equation (35) can be written in terms of export price as :

$$\text{Ln UVIX} = \Psi_1 + \Psi_2 \text{ Ln y} + \Psi_3 \text{ Ln expt}^s + \Psi_4 \text{ Ln P} \qquad ...(37)$$

where $\Psi_1 = (-\theta_1/\theta_3)$, $\Psi_2 = (-\theta_2/\theta_3)$
$\Psi_3 = (1/\theta_3)$ and $\Psi_4 = 1$

Equation (37) was estimated in a partial adjustment framework dropping exports to avoid its strong correlation with income. The empirical equation which also included a dummy variable to account for sharp fluctuation in export prices in some years is presented below:

$$\begin{aligned}\text{Ln UVIX} = {} & -3.467 + 0.158 \text{ Ln P} + 0.728 \text{ Ln y} \\ & (-3.131) \quad (1.319) \qquad (2.992) \\ & + 0.482 \text{ Ln UVIX}_{(-1)} + 0.127 \text{ DUVIX} \qquad ...(38) \\ & (4.958) \qquad (6.532)\end{aligned}$$

$\bar{R}^2 = 0.99$ h = -1.09, SEE = 0.038, Mean = 4.929

The index of export price is given by pexp$ = (UVIX/IE), where 'IE' is an index of nominal exchange rate (Rupee to US$). Exchange rate in this framework plays the passive role of transforming the Rupee price of exports into dollar. An exchange rate depreciation, *ceteris paribus*, will bring down the export price and stimulate export demand, depending on the value of price elasticity of exports. Therefore, as in the case of pass through framework, the price elasticity of exports in the model determines the degree with which the trade volumes adjust to a change in the exchange

rate (Patra and Pattanaik, 1994). Following equation provides the estimates of exchange rate which is related to domestic price level, current account balance (*minus* indicating deficit) and the change in Reserve Banks' foreign assets (ΔRBFA).

$$\begin{aligned} EXR = {} & 5.929 + 0.029\ P - 0.033\ CAB + 0.060\ \Delta RBFA \\ & (10.242)\quad (3.898)\quad (-4.655)\qquad (11.336) \\ & + 10.936\ DEXR1 + 4.691\ DEXR2 \qquad \ldots(39) \\ & (14.050)\qquad\quad (5.596) \end{aligned}$$

$\bar{R}^2 = 0.99$, DW = 2.13, SEE = 0.639, Mean = 12.84

The signs of the coefficients in the equation are consistent with the theoretical expectation about the influence of various economic forces on the exchange rate. An increase in domestic price level and current account deficit causes the exchange rate to depreciate. In the similar manner an increase in RBI's absorption of foreign currency will tend to depreciate the Rupee. The marginal increase in exchange rate (depreciation) due to an increase in wholesale price index and current account deficit in the model are placed at 0.013 and 0.033, respectively. These coefficient values reveal the weak influence of domestic price and current account balance on exchange rate. This goes to explain the relative insulation of exchange rate determination from the economic forces during much of the sample period. The equation includes two Dummies (DEXR1 and DEXR2) to represent the readjustment of the value of the Rupee in 1991-92 and the sharp depreciation in 1992-93, respectively.

Equations 35, 38 and 39 provide the basic building block for the export sector in the model and underline the two way influence of a domestic price change on export price. Domestic price exerts simultaneous impact on unit value index of exports and exchange rate. The unit value index of exports essentially reflects the prevailing domestic cost conditions. Therefore, an increase in domestic price is expected to harden the rupee price of exports and negatively affect the demand for exports. This is true for an economy with passive and fixed exchange rate system. In India, the system

of managed float remained in force for a long time, eventually replaced in stages by a market determined exchange rate system. Even within the system of managed float, exchange rate had been responding to domestic price changes, *albeit* at a slow pace. The empirical estimates of price coefficient in the exchange rate equation also reveal the slow rate of adjustment between nominal exchange rate and price. Allowing for this impact, an increase in domestic price is expected to cause a depreciation in nominal exchange rate and partially neutralise the increase in the supply price of exports.

The demand for real imports of goods and services (impt) is posited as a function of the level of economic activity and import prices (PIMP) relative to domestic price. Unlike the conventional specifications that make import demand a function of real income, the specification considered here relates imports to an aggregate demand variable (ad), which is defined as the sum of private sector absorption, government expenditure and exports, all in real terms. Each of these sectors generate demand for imports, so that the actual import reflects a certain portion of the planned import. The equation includes two dummies, representing the import restriction measures put in place during the stabilisation programmes in 1991-92 and the sharp decline in services imports in certain years.

$$\begin{aligned} \text{Ln impt} = {} & -2.115 + 0.641\ \text{Ln ad} - 0.462\ \text{Ln PIMP} \\ & (-2.858)\ (4.206) \qquad (-10.778) \\ & + 0.967\ \text{Ln P} - 0.111\ \text{DIMPT1} \\ & (8.888) \qquad (-2.411) \\ & - 0.182\ \text{DIMPT2} \qquad \text{..(40)} \\ & (-8.060) \end{aligned}$$

$\bar{R}^2 = 0.99$, DW = 1.95, SEE = 0.04, Mean = 5.04

The elasticity of real imports of goods and services with respect to the aggregate real demand is estimated at 0.64 and with respect to import prices at 0.46. The elasticity of imports to domestic price level is placed at 0.97.

**Interest Income and Payments**

A large part of the interest income from external sources accrues by way of income from investment of foreign assets held by RBI. Therefore, the external interest income in Rupee value (XII) is related to RBI's foreign assets and the world interest rate, proxied by one year LIBOR.

$$XII = \underset{(0.485)}{0.678} + \underset{(5.526)}{0.037}\ RBFA_{(-1)} + \underset{(1.785)}{0.177}\ LBR \qquad ...(41)$$

$$\bar{R}^2 = 0.87, \quad DW = 1.62, \quad SEE = 0.91, \quad Mean = 1.116$$

External interest payment (XIP) has two components, interest payment on government external debt, which is determined in the fiscal sector and that on private external debt. Interest payment on private external debt is related to the average interest rate on private debt ($I^p_x$) and the beginning of the year outstanding private debt ($XDBT^p_{(-1)}$). Hence,

$$IPX = IPX^g + IPX^p \qquad ...(42)$$

$$IPX^p = I^p_x \times XDBT^p_{(-1)} \qquad ...(43)$$

$$XDBT = \Delta XDBT + XDBT_{(-1)} \qquad ...(44)$$

The stock of private external debt is expressed as;

$$XDBT^p = XDBT - XDBT^g \qquad ...(45)$$

The incremental external debt (ΔXDBT) is a function of the current account deficit in the balance of payments and the change in RBI's foreign assets.

$$\Delta XDBT = \underset{(1.304)}{8.575} - \underset{(-13.669)}{1.354}\ CAB + \underset{(7.585)}{0.610}\ \Delta RBFA + \underset{(27.992)}{677.359}\ DXDBT \qquad ...(46)$$

$$\bar{R}^2 = 0.98, \quad DW = 2.35, \quad SEE = 22.54, \quad Mean = 106.91$$

Where 'DXDBT' is a dummy representing the break in the data series in 1991-92 arising out of the change in the classification of

external debt since that year. Short term debts have been excluded from the analysis in order to obtain a comparable data series for the sample period. Ideally, the incremental external debt should equal the current account deficit *minus* the drawals from reserves. Reserves could also be accumulated by borrowing from abroad, in which case it would add to the external debt. The signs of the coefficient of current account balance and the change in RBI's foreign assets show a positive association of both these components with the incremental external debt.

## Section IV
## The Model and its Simulation Performance

The complete model is specified in terms of 26 behavioural equations and 33 identities. There are 49 exogenous variables and 17 lagged endogeneous variables in the model. Applying the order condition it may be seen that the individual equations do not suffer from the over-identification problem. Thus specified, this medium size model attempts to integrate all the major sectors of the economy, with the primary objective to study the monetary, growth and balance of payments implications of the fiscal policy. All the parameter estimates of the individual behavioural equations, barring a few, satisfy the criteria of goodness of fit and have *a priori* signs and magnitudes. The complete structure of the model including the identities and definition of variables are reported in Table 1.

The model has been solved by running deterministic simulation in both static and dynamic framework for the period 1975-76 to 1993-94. Based on the comparison of predicted and actual values, Table 2 reports three types of simulation error statistics e.g., the Mean Absolute Percentage Error (MAPE), Root Mean Square Percentage Error (RMSPE) and Theil's 'U' statistic for some key endogenous variables. For most of the variables MAPE and RMSPE, both under static and dynamic simulations, stayed within a reasonable range. For example, in the case of some key variables such as government revenue (TR), government expenditure (GXP), money supply ($M_3$), wholesale price (P), capital stock (kagr and knagr), real output (y), exports (expt$) and imports (impt) the RMSPEs under dynamic simulation are within the range of 1 to 7 per cent. The RMSPE for

fiscal deficit is placed at 13.7 per cent under dynamic simulation while for current account balance it is placed at 74.2 per cent. Since these two variables represent the closing identities of the fiscal and external sectors, respectively, the relatively large RMSPE in these two indentities reflect the accumulated errors stemming from the individual equation components in these two sectors.

**Table 2**
**Simulation Error Statistics of Some Key Endogenous Variables in the Model**

| Endogenous Variables | Static Simulation | | | Dynamic Simulation | | |
|---|---|---|---|---|---|---|
| | MAPE | RMSPE | Theil's 'U' | MAPE | RMSPE | Theil's 'U' |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| **Fiscal Sector** | | | | | | |
| TR | 1.39 | 2.60 | 0.01 | 4.12 | 5.77 | 0.04 |
| GXP | 1.16 | 1.99 | 0.01 | 2.09 | 4.18 | 0.02 |
| FD | 4.99 | 12.34 | 0.06 | 7.41 | 13.70 | 0.07 |
| RCG | 2.04 | 4.71 | 0.02 | 4.36 | 7.90 | 0.05 |
| **Real Sector** | | | | | | |
| pc | 1.17 | 1.67 | 0.01 | 1.35 | 1.71 | 0.02 |
| piag | 7.77 | 8.76 | 0.09 | 10.14 | 11.54 | 0.12 |
| pinag | 10.46 | 12.11 | 0.13 | 12.28 | 15.39 | 0.15 |
| yar | 2.43 | 3.34 | 0.03 | 4.05 | 4.65 | 0.04 |
| ynar | 0.93 | 1.12 | 0.01 | 1.81 | 1.98 | 0.02 |
| y | 1.00 | 1.61 | 0.01 | 1.62 | 2.08 | 0.02 |
| kagr | 0.48 | 0.59 | 0.01 | 0.81 | 0.97 | 0.01 |
| Kngar | 0.47 | 0.58 | 0.01 | 1.43 | 1.51 | 0.02 |
| **Monetary Sector** | | | | | | |
| RM | 1.87 | 3.70 | 0.02 | 3.93 | 6.51 | 0.05 |
| $M_3$ | 2.48 | 2.92 | 0.03 | 4.57 | 6.56 | 0.05 |
| P | 2.14 | 2.82 | 0.02 | 4.68 | 5.35 | 0.05 |
| IB | 6.21 | 6.84 | 0.07 | 6.29 | 6.76 | 0.08 |
| **External Sector** | | | | | | |
| EXR | 3.23 | 4.61 | 0.04 | 3.87 | 6.10 | 0.05 |
| expt$ | 0.40 | 3.36 | 0.04 | 0.51 | 4.41 | 0.05 |
| PEXP$ | 2.70 | 3.66 | 0.03 | 4.00 | 5.21 | 0.04 |
| impt | 2.74 | 3.48 | 0.03 | 3.87 | 4.77 | 0.05 |
| CAB | -23.55 | 116.02 | 0.23 | -19.89 | 74.23 | 0.22 |
| XDBT | 3.53 | 5.85 | 0.03 | 4.51 | 9.79 | 0.05 |

MAPE = Mean Absolute Percentage Error.
RMSPE = Root Mean Square Percentage Error.

Theil's 'U' coefficient as a measure of robustness of the model shows the extent of inequality between the actual and simulated values. If 'U' is 0, there is perfect agreement between the actual and the simulated series. In our case the `U' for most of the key endogenous variables is less than 0.1.

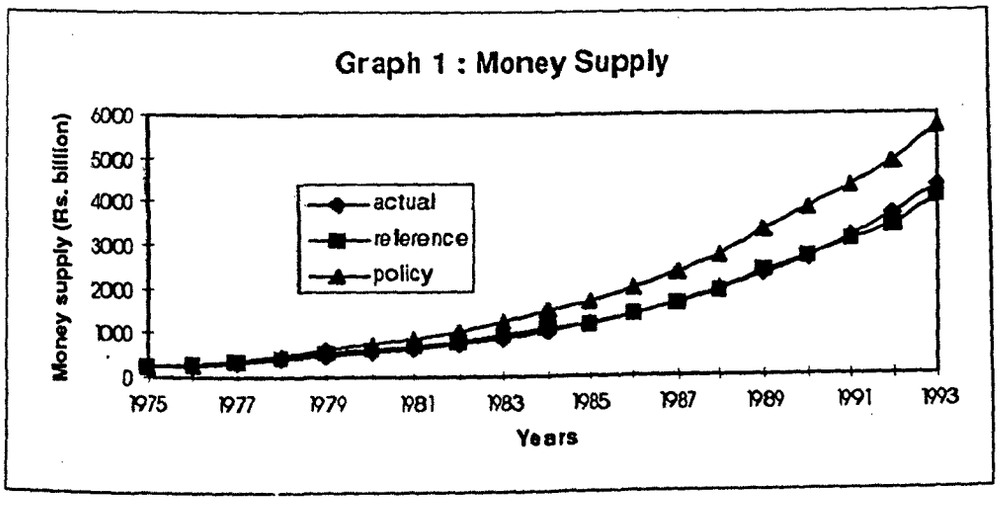
Graphs '1 to 4' show the comparison of actual and simulated (reference) values of the key endogenous variables in the dynamic simulation. For most of the variables the turning points are captured by the simulation. For example, in the case of fiscal deficit and current account balance, the two key endogenous variables in the model, the graphs show the close convergence of simulated series with the actual series. This is also true of the variables like money supply, prices and real income. With the limited available data points the model has captured reasonably well the structural changes in the Indian economy since 1991-92.

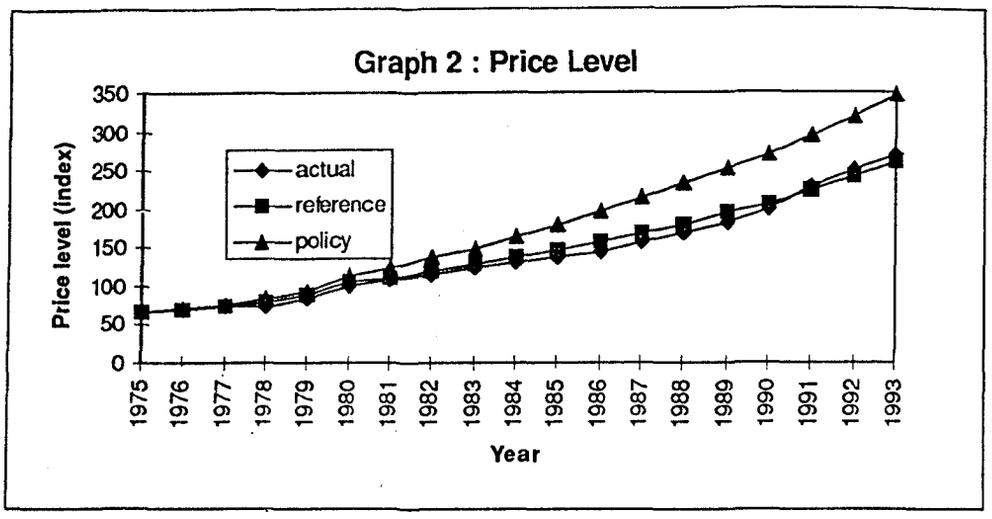
On the whole, the model performs well in terms of tracking the historical path of the majority of variables. While according to the actual data the average annual rate of inflation and output growth are placed at 8.14 per cent and 4.66 per cent, respectively, during the period 1976-77 to 1993-94, the predicted values of the same variables from the dynamic simulation are placed at 7.90 per cent and 4.64 per cent, respectively. Similarly, the annual average ratios of fiscal deficit to GDP (market price) and current account balance to GDP (market price) are predicted by the simulation at 6.62 per cent and -1.26 per cent, respectively, for 1975-76 to 1990-91 as against the actual ratios of 6.85 per cent and -1.24 per cent.

## Section V
## Policy Simulation

A basic objective of the empirical model presented is to study the economy-wide ramifications of fiscal impulses which could stem from a policy induced change in one of the exogenous fiscal variables. Fiscal deficits pose various trade-offs for the economy. Such trade-offs involve securing growth and price stability, on the one

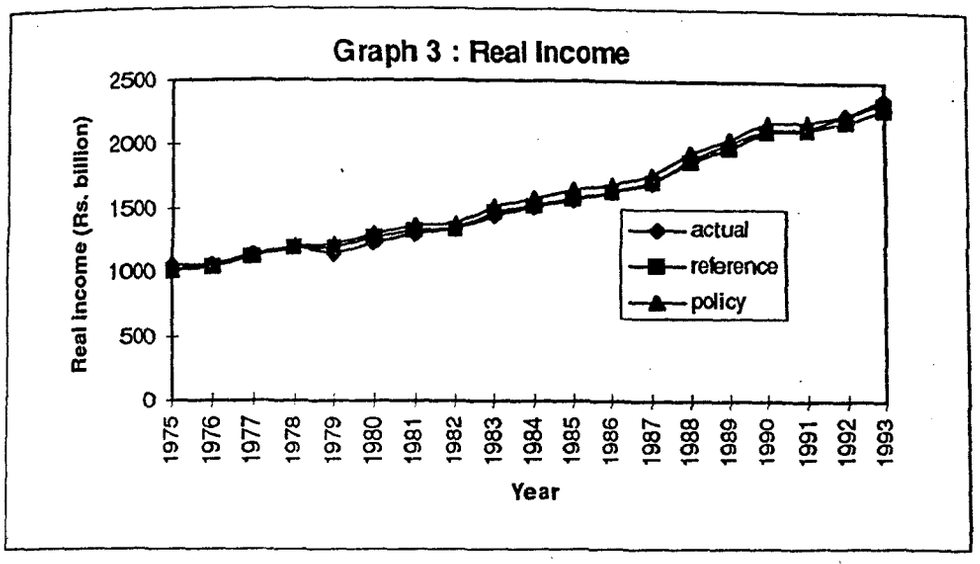
hand, and maintaining internal and external balances, on the other. Fiscal deficit as a means to promote growth has been well recognised in the literature. Its efficacy to do so however, depends on what happens to various intermediate variables such as prices, interest rate, credit, investment and external leakages such as imports, which are influenced by the fiscal deficit. When deficit is financed by money creation the trade-off becomes sharper in terms of higher inflation. Apart from the adverse price impact, fiscal deficit implies higher level of domestic absorption which can trigger an increase in imports and widening of current account deficit in the balance of payments. To be sure, the exact nature of the impact of an increase in fiscal deficit on domestic prices and external deficit would depend on various factors, such as the nature of linkages established in the model, the estimated values of the impact coefficients and the lags in the model which provide feed back effects to the system. The policy simulation excercise conducted in this section is intended to study four types of macro-economic outcomes stemming from changes in the policy variables. In the first excercise public real non-agricultural investment is raised by small magnitudes over its historical values during the sample period (1975-76 to 1993-94) in order to study the implications of this policy change for growth, prices, and balance of payments under the alternative financing scenarios. These financing scenarios fall under three major heads; (a) financing by money creation, (b) financing partly by a rise in public sector saving and partly by money creation and (c) financing by an increase in commercial bank credit to the govern-

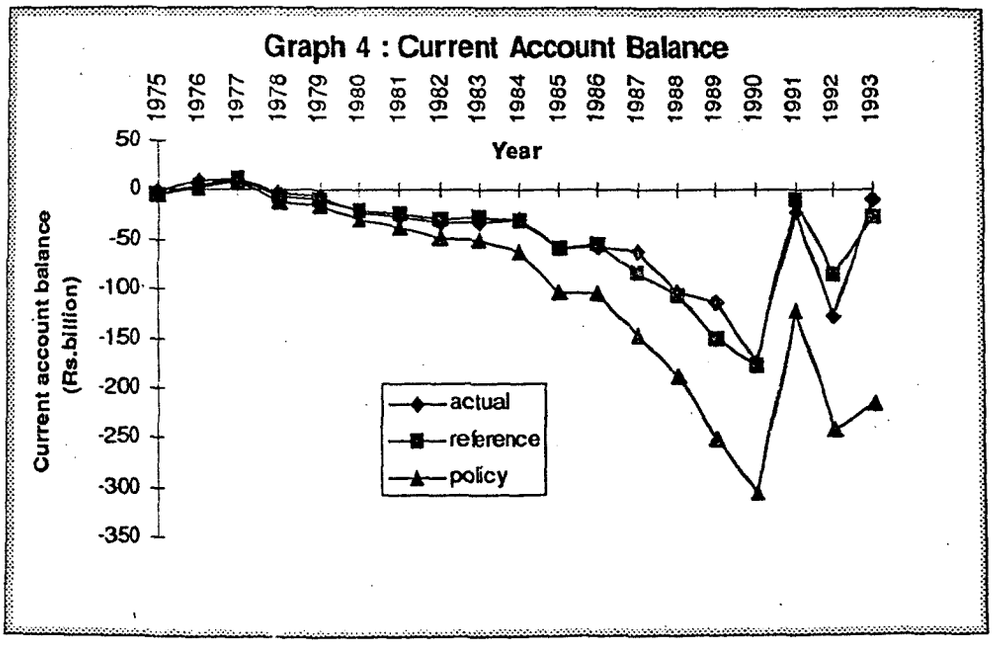





ment sector. In the second excercise, we study the implications of an increase in government current expenditure, financed by bank credit for the price level, output and balance of payments. In the third excercise, the model is given a pure monetary shock in the form of an increase in the RBI's foreign assets. The impact of this policy change is studied by analysing the changes in paths of the endogenous variables such as money supply, prices, output, exchange rate and the external current account balance. The fourth experiment relates to an increase in world income and its possible implications for exports and the current account deficit in the balance of payments.

In order to evaluate the comparative outcomes, the model is first solved on its dynamic mode by holding all exogenous variables to their historical levels. The simulated path of the variables therefore provide the model generated solutions of the endogenous variables during the sample period. In order to allow for policy induced change to be transmitted throughout the system, a particular exogenous variable is choosen for altering its temporal path during the sample period. The repeated shock arising out of this policy change is allowed to work through the system alongwith the feedback effects to provide the policy solutions for the endogenous variables. The policy solutions are compared with the reference solutions with a view to evaluating the impact of the policy change on some key endogenous variables.




## 1. Increased Public Investment

Public investment which is an exogenous variable in the model is divided into two broad categories, *viz;* agriculture and non-agricultural investment. Public investment has a two-fold role in the model. It directly adds to the capital stock and generates output with a lag. In the non-agricultural sector public capital also

competes with private capital to the extent that it crowds out the private sector in the credit market.

In the simulation experiment real public investment in the non-agricultural sector is raised by 10 per cent over its historical level in each year of the simulation period. There are three key endogenous variables to which this policy change may be addressed; output, prices and current account deficit in the balance of payment. The impacts of this policy under three different financing scenarios are discussed below.

### a) Implications Under the Monetary Financing Scenario

The increased investment expenditure will have an immediate expansionary effect on fiscal deficit, raising the need for net RBI credit to the government. As a result, the reserve money will grow passively with the feed-back from RBI credit, leading to expansion in money supply and consequent increase in prices. The ensuing output effect is however, expected to moderate the price rise to some extent. The initial deterioration in the budget balance will feed itself back into the system to the extent that the interest payments will grow in the next period to service the higher level of public debt.[5] The budget balance will also depend on the degree and speed with which government revenues and expenditures adjust to the changes in price and output. On the other hand, the output effect on the budget balance is expected to be favourable given the built-in-elasticity of tax system. On the financing side, while government borrowing from household is structurally related to nominal output, borrowing from banks is related to growth in bank deposits and in turn to money supply. Consequently, domestic non-monetary borrowing of the government will rise to partly finance the deterioration in the budget balance in the subsequent period. The need for monetary financing will, however, grow until the budget deficit returns to a stable equilibrium value. The repeated shock by way of continuous increases in public investment will set in motion a cycle of adjustment involving money, prices, output and budget deficit, until all endogenous variables in the model reach to their new long run equilibrium values.

Another dimension of the higher public investment expenditure relates to its impact on the balance of payments. The output and price effects of public investment outlay are expected to be accompanied by a deterioration in the current account deficit in the balance of payments. This happens as a part of the increase in domestic absorption stemming from the higher government expenditure spills over to the external current account through a rise in imports. Apart from this income effect, the current account deficit will also be influenced by the changes in relative prices in the wake of a change in domestic price. There are two routes in the model through which the domestic price affects the relative price, the direct effect, where the unit value index of exports is positively related to domestic price and the indirect effect, where the dollar price of exports is negatively related to exchange rate. An increase in domestic price will increase the supply price of exports, resulting in a rise in unit value index of exports. The rise in Rupee price of exports will be counteracted to some extent by the depreciation in nominal exchange rate. Consequently, the net impact of the domestic price change on the dollar price of exports, and hence on the export volume, will depend on the relative strength of both the factors. Since imports are positively related to domestic price, an increase in the latter will also cause the former to rise. The domestic price implications of higher public investment spending, therefore, turns out to be a crucial factor for the current account deficit in the balance of payment.

The quantitative impacts of the above policy simulation on key endogenous variables are presented in Table 3. The impact change refers to the immediate change (within the same year) in the endogenous variables in response to a change in the policy variable, the change is worked out as the percentage deviation in the variable over the base line or reference simulation.

$$d = \frac{1}{n} \sum_{i=1}^{n} \frac{(y^s - y^p)}{y^s}$$

Where 'd' is the annual average percentage deviation from the base line simulation, 'n' is number of years in the simulation period, '$y^s$'

is the value in the reference simulation (dynamic), and '$y^p$' is value in the policy simulation The short run impact refers to the annual average percentage deviation from the base line simulation during the first two years while the long run impact relates to the annual average percentage change during the entire sample period.

The immediate impact of the policy change is a rise in fiscal deficit and money supply by 16.98 per cent and 3.51 per cent, respectively, over their respective reference solutions in the same year of the increase in public investment. The initial price effect is placed at 0.69 per cent. Real net capital stock in non-agriculture sector and real income are higher by 0.60 per cent and 0.47 per cent, respectively, in the first year. Given the one-period lag between capital stock and output, the initial output effect stems from two sources *viz;* the higher level of credit flow to the production sectors which has come about by the higher level of real money stock and the short run adjustment of output to domestic demand conditions. The increase in domestic absorption creates an instantaneous demand for real imports, which rises by 1.58 per cent in the first year while exports in constant dollar fall marginally by 0.01 per cent, a result that follows from the change in the relative prices against exports. Consequently the current account deficit in the balance of payment shows a deterioration of 17.04 per cent in the first year of the policy change. In terms of ratio to GDP, current account deficit registers an increase of 0.08 percentage point from the reference simulation.

In the short to medium run, the adverse price and balance of payment effects continue to dominate the output effect. While during the first two years the price level rises by an average rate of 1.3 per cent, the growth in output is placed at 0.72 per cent and current account deficit deteriorates by 24.97 per cent (0.13 per cent of GDP). The short run scenario, in other words, shows a faster rate of deterioration in the internal and external balances than what was witnessed in the immediate horizon.

**Table 3 : Policy Simulation 1(a)**
**Impact of Sustained 10 per cent increase in Real Public Investment in Non-agriculture Sector Financed by Money Creation**

| Endogenous Variables | Annual Average Percentage Deviation from the Base-Line Simulation | | |
|---|---|---|---|
| | Impact (first year) | Short run (first two years' average) | Long run (sample period average, 1975-76 to 1993-94) |
| Fiscal Deficit | 16.98 | 18.13 | 41.50 |
| Government Revenue | 0.60 | 1.08 | 16.10 |
| Government Expenditure | 4.78 | 5.46 | 21.92 |
| Money Supply $M_3$ | 3.51 | 5.34 | 29.31 |
| Prices | 0.69 | 1.30 | 18.13 |
| Real Capital Stock in Non-Agriculture Sector | 0.60 | 0.97 | 4.44 |
| Real Income | 0.47 | 0.72 | 2.66 |
| Real Exports (US$) | -0.01 | -0.06 | 3.97 |
| Real Imports (Rs.) | 1.58 | 2.39 | 20.66 |
| Exchange Rate* | 0.43 | 0.68 | 15.62 |
| Current Account Deficit (Rs.)** | 17.04 | 24.97 | 161.65 |
| (as % of GDP) | (0.08) | (0.13) | (0.67) |
| External Debt | 0.80 | 1.42 | 32.54 |
| Interest Payment on External Debt | 0.00 | 0.001 | 34.14 |

* (+) Implies depreciation and (-) appreciation
** (+) Implies increase in deficit and (-) decrease

In the long run, the price and balance of payments situation continue to show sharp deterioration. As the gap between revenue and expenditure increases steadily with inflation and rising stock of public debt, the fiscal deficit rises by an annual average rate of 41.50 per cent, leading to a money supply growth of 29.31 per cent. Prices on an average rise by 18.13 per cent, while real income goes up by an annual average rate of 2.66 per cent. External payments situation records a sharp deterioration with the real import growth averaging 20.66 per cent, and real export in US

dollars showing only a small growth of 3.97 per cent, which is primarily caused by the exchange rate depreciation brought about by the combined influence of domestic price increase and the spurt in the current account deficit. The deficit in the current account rises by an average of 161.65 per cent or 0.67 per cent of GDP in the long run. In terms of magnitude, the current account deficit would have increased to 2.08 per cent of GDP in 1993-94, compared to the reference value of 0.36 per cent. Graph 1 to 4 provides the plots of actual, reference simulation and policy outcomes of major endogenous variables.

As may be seen from the graphs while the real output growth in the long run starts to taper off, inflation and balance of payment deficits increase to an unsustainable position, reflecting the relative inefficacy of the policy to achieve sustained output growth through monetary expansion.

### (b) Financing Implications Under Increased Public Saving and Money Financing

In this scenario the additional public investment is assumed to be financed partly by an increase in savings of public enterprises while the savings of government administration evolves endogenously with the government revenue and expenditure growth. Historically, the proportion of nominal saving of public enterprises to public investment in the non-agricultural sector varied between 15 to 85 per cent during the sample period 1975-76 to 1993-94. It would seem reasonable to expect that the gross saving of public enterprises rise along with the public investment at a pace which would maintain the above ratios unaltered during the sample period. Implicit in this is the assumption that the gap between the incremental investment and saving in each year is financed by money creation.

The quantitative changes recorded in the key endogenous variables under this financing scenario are summarised in Table 4.

**Table 4 : Policy Simulation 1(b)**
**Impact of Sustained 10 per cent increase in Public Real Investment in Non-agriculture Sector Financed by Increased Public Saving and Money Creation**

| Endogenous Variables | Annual Average Percentage Deviation from the Base-Line Simulation | | |
|---|---|---|---|
| | Impact (first year) | Short run (first two years' average) | Long run (sample period average, 1975-76 to 1993-94) |
| Fiscal Deficit | 14.31 | 14.84 | 25.13 |
| Government Revenue | 1.34 | 1.86 | 12.40 |
| Government Expenditure | 4.66 | 5.20 | 15.34 |
| Money Supply | 2.98 | 4.41 | 18.71 |
| Prices | 0.58 | 1.07 | 11.37 |
| Real Capital Stock in Non-Agriculture Sector | 0.57 | 0.91 | 3.88 |
| Real Income | 0.43 | 0.64 | 2.29 |
| Real Exports (US$) | -0.01 | -0.07 | 2.11 |
| Real Imports (Rs.) | 1.38 | 2.02 | 13.24 |
| Exchange Rate* | 0.37 | 0.56 | 9.74 |
| Current Account Deficit (Rs.)** | 14.89 | 21.05 | 96.35 |
| (as % of GDP) | (0.07) | (0.07) | (0.46) |
| External Debt | 0.70 | 1.22 | 21.88 |
| Interest Payment on External Debt | 0.00 | 0.02 | 23.22 |

* (+) Implies depreciation and (-) appreciation
** (+) Implies increase in deficit and (-) decrease

The long run impacts on prices and balance of payments under this financing scenario are significantly different from the pure monetary financing scenario. In the long run the annual average increase in fiscal deficit works out to 25.13 per cent, giving a money supply growth of 18.71 per cent over the reference simulation. The price level shows an annual average increase of 11.37 per cent in the long run. It may be noted that the substantial moderation in the price rise compared to the pure monetary financing scenario has come about through a small loss in output growth. The annual average growth in real output over the reference solution is placed at 2.29 per cent under this scenario com-

pared to 2.66 per cent in the pure monetary financing scenario. The ratio of current account deficit to GDP goes up by an annual average rate of 0.46 per cent in the long run. Under this policy excercise, or what may be referred to as restrained monetary expansion scenario, the price and balance of payments impacts remain adverse suggesting that a policy favouring growth in public investment inconsistent with the saving effort would likely to affect the long term prospects of maintaining a sustainable price and balance of payment situation.

### (c) Financing Implications Under Increased Bank Credit to Government

Borrowing from market mainly commercial banks constitutes an alternative source of financing the additional public investment. Under the bond financing scenario, the macro-economic impact of fiscal deficit would depend on several factors such as the impact on interest rate, availability of credit to the private sector and the growth of absorption relative to growth in output. Theoretically, operating under a non-accommodating monetary policy environment, an increase in supply of government bonds is expected to increase the interest rate and adversely affect the economic activity elsewhere. Another consequence of the policy is that the increased flow of bank credit to government could imply reduction of credit for private sector capital formation. These adverse outcomes would have to be evaluated against the monetary stability of the policy which is likely to follow in absence of automatic growth in money supply on account of increase in fiscal deficit.

The policy simulation of above experiment required some change in the framework of the model. Bank credit to government, which was behaviourally determined in the model had to be expressed as an identity while the Reserve Bank credit to government, an endogenous variable earlier, had to be made exogenous. Under this policy experiment commercial bank credit to government is treated as the residual capital receipt to fill the gap between the fiscal deficit and borrowing from all other sources, including the Reserve Bank credit to government. The results of this policy outcome are presented in Table 5.

**Table 5 : Policy Simulation 1(c)**
**Impact of Sustained 10 per cent increase in Public Real Investment in Non-agriculture Sector financed by increase in Commercial Bank Credit to the Government**

| Endogenous Variables | Annual Average Percentage Deviation from the Base-Line Simulation | | |
|---|---|---|---|
| | Impact (first year) | Short run (first two years' average) | Long run (sample period average, 1975-76 to 1993-94) |
| Fiscal Deficit | 15.39 | 15.11 | 17.88 |
| Government Revenue | 0.10 | 0.12 | –0.12 |
| Government Expenditure | 3.93 | 3.90 | 4.04 |
| Money Supply | — | — | — |
| Prices | –0.09 | –0.16 | –0.74 |
| Commercial Bank Lending Rate | 0.84 | 1.28 | 0.76 |
| Real Private Investment in Non-Agriculture Sector | –2.55 | –2.90 | –8.27 |
| Real Capital Stock in Non-Agriculture Sector | 0.36 | 0.51 | 0.82 |
| Real Income | 0.24 | 0.32 | 0.57 |
| Real Exports (US$) | –0.04 | –0.10 | –0.80 |
| Real Imports (Rs.) | 0.42 | 0.37 | –6.37 |
| Exchange Rate* | 0.05 | –0.01 | –0.49 |
| Current Account Deficit (Rs.)** | 6.15 | 3.87 | –4.79 |
| (as % of GDP) | (0.03) | (0.02) | (–0.03) |
| External Debt | 0.21 | 0.24 | –0.97 |
| Interest Payment on External Debt | — | –0.37 | –3.47 |

* (+) Implies depreciation and (-) appreciation
** (+) Implies increase in deficit and (-) decrease

The outcomes under this policy are perceptibly different from the two other scenarios discussed above. An immediate impact of the policy is that while fiscal deficit rises by about 15.39 per cent in the same year of the increase in public investment, the ensuing output growth (0.24 per cent) and the unchanged level of money stock bring about a marginal decline in prices. Higher credit flow to government crowds out private investment in the non-agriculture

sector by 2.55 per cent, although the aggregate capital stock in non-agricultural sector rises by 0.36 per cent. This is reminiscent of partial crowding out situation, implying that a part of the loss of bank credit to private sector is made good by the enterprises through other sources. This method of financing government investment also raises the commercial banks' lending rate by 0.84 per cent and affects private investment. The current account deficit witnesses a deterioration of the order of 6.5 per cent (0.03 percentage points in terms of ratio of GDP) mainly brought out by the growth of 0.42 per cent in real imports and a decline of 0.04 per cent in exports. In the short to medium run, fiscal deficit grows by 15.11 per cent per annum, while the impact on other variables are broadly on the lines of those witnessed in the immediate horizon.

In the long run, real capital stock in non-agricultural sector and output growth are placed at 0.82 per cent and 0.57 per cent, respectively, while private real investment declines at a faster rate of 8.27 per cent, resulting in the loss of much of the potential output. The resource gap of the government shows an annual average increase of 17.88 per cent. As the decline in the price level strengthens in the long run, the real money stock and aggregate demand level falls, and the relative price changes in favour of domestic goods, causing a decline in the real import. This shows up in the perverse effect of some improvement in current account balance. The relative price changes therefore, have a powerful impact on the current account deficit in the balance of payments.

## 2. Increased Current Expenditure Financed by Bank Credit

A policy induced increase in government current expenditure, financed by borrowing from the credit market is associated with both adverse price and income effects as well as a deterioration in the balance of payment situation. In this policy simulation government nominal current transfers (excluding interest payments) which is an exogenous variable in the model was increased by 10 per cent over its actual value in each year of the sample period. The quantitative outcomes of this policy are presented in Table 6.

**Table 6 : Policy Simulation 2.**
**Impact of Sustained 10 per cent increase in Government Current Transfers Financed by Bank Credit**

| Endogenous Variables | Annual Average Percentage Deviation from the Reference Simulation | | |
|---|---|---|---|
| | Impact (first two year) | Short run (first two years' average) | Long run (sample period average, 1975-76 to 1993-94) |
| Fiscal Deficit | 3.34 | 3.50 | 5.82 |
| Money Supply | — | — | — |
| Real Income | 0.02 | 0.01 | -0.34 |
| Prices | -0.01 | -0.01 | 0.35 |
| Real Exports (US$) | -0.003 | -0.004 | 0.36 |
| Real Imports (Rs.) | 0.03 | 0.03 | 0.19 |
| Exchange Rate* | neg. | neg. | 0.23 |
| Current Account Deficit (Rs.)** | 0.45 | 0.29 | 3.42 |
| (as % of GDP) | neg. | neg. | 0.01 |
| External Debt | 0.02 | 0.02 | 0.28 |

* (+) Implies depreciation and (-) appreciation.
** (+) Implies increase in deficit and (-) decrease.
Neg.: Negligible.

It is evident that higher levels of current expenditure imply long run adverse macro-economic outcomes for the economy which stems from reduction in output level, increased pressure on prices and a deterioration in the current account deficit. This is in contrast to the policy outcomes of financing a higher level of public investment through credit from the market. Public investment, despite its adverse 'crowding out' impact on private investment raises the output level in the economy and may not imply severe long run balance of payments effects, if not financed by money creation. Efforts to reduce government expenditure should be therefore targetted at current expenditures, which have potential adverse macro-eonomic consequences for the economy.

## 3. Increased Reserve Bank's Foreign Assets

A pure monetary shock to the model by way of an increase in Reserve Bank's Foreign Assets (RBFA) is expected to work through the system in two ways. First, RBFA constitutes a part of the reserve money, hence there will be an immediate expansionary impact on money supply and prices. Higher real money balances would also go to enhance the credit flow to real sector, leading to some increase in output. The relative prices in the trade sector will however undergo a change with implications for trade flows. Secondly, RBFA has a direct implication for exchange rate, which would tend to depreciate with higher absorption of foreign exchange by RBI from the market. This constitutes a second channel of impact on the external balance. The quantitative dimension of this policy change on the key endogenous variables are reported in Table 7.

**Table 7 : Policy Simulation 3.**
**Impact of Sustained 10 per cent increase in Reserve Bank Foreign Assets**

| Endogenous Variables | Annual Average Percentage Deviation from the Reference Simulation | | |
|---|---|---|---|
| | Impact (first year) | Short run (first two years' average) | Long run (sample period average, 1975-76 to 1993-94) |
| Money Supply | 0.73 | 1.44 | 1.75 |
| Prices | 0.17 | 0.40 | 1.41 |
| Fiscal Deficit | 0.36 | 0.80 | 1.54 |
| Real Income | 0.04 | 0.08 | 0.02 |
| Real Exports (US$) | 0.25 | 0.36 | 0.46 |
| Real Imports (Rs.) | 0.22 | 0.50 | 1.44 |
| Exchange Rate* | 0.70 | 0.92 | 1.26 |
| Intertest Income on External Investment | — | 29.28 | 40.33 |
| Current Account Deficit (Rs.)** | -0.34 | -4.63 | 1.36 |
| External Debt | 0.47 | 0.66 | 1.37 |

* (+) Implies depreciation and (-) appreciation
** (+) Implies increase in deficit and (-) decrease

In the first year of the increase in RBFA, money supply increases by 0.73 per cent and price level by 0.17 per cent. The price rise sets in motion an adjustment in government revenues and expenditure and fiscal deficit expands by 0.36 per cent, leading to borrowing from Reserve Bank in the second stage of impact. Real income is higher by 0.04 per cent in the first year. Exchange rate witnesses a depreciation of 0.70 per cent under the combined impact of domestic inflation and Reserve Bank's absorption of foreign exchange from the market. This produces an export growth in dollar terms of 0.25 per cent, while imports in real terms rise by 0.22 per cent. The current account deficit improves by 0.34 per cent over the reference simulation.

In the short to medium run money supply rises at an annual average rate of 1.44 per cent, leading to a price rise of 0.4 per cent. The annual increase in output averages 0.08 per cent. In the long run the balance of payment records a deterioration, as the adverse price effects cause imports to rise at a faster rate, despite an increased rate of depreciation in exchange rate. This shows that containing domestic inflation through other policy measures such as sterilisation has to play a critical role, if the depreciation in exchange rate should have an enduring favourable impact on the current account balance.

## 4. Growth in World Income

Growth in world income is expected to increase exports of goods and services and improve the current account balance. The economy-wide implications of this change can be studied by solving the model with the repeated favourable shocks during the sample period. The policy experiment conducted in this section is therefore intended to capture the temporal changes in key endogenous variables following one per cent increase in world real income (index) over the observed levels in each year of the sample period. This favourable shock to the external sector is expected to work through the model in the following way.

An increase in world income will have an immediate favourable impact on the current account balance. The decline in current ac-

count deficit will reduce the stock of external debt and interest payment, leading to further improvement in external balance. However, some of the gains accruing from this favourable shock will be neutralised by higher imports stemming from the increase in domestic absorption and appreciation of exchange rate following the reduction in current account deficit.

The quantitative dimension of this policy change is given in Table 8.

**Table 8 : Policy Simulation 4.**
**Effects of Sustained 1 per cent increase in World Income (index) Over the Actual Level**

| Endogenous Variables | Annual Average Percentage Deviation from the Base Line Simulation | | |
|---|---|---|---|
| | Impact (first year) | Short run (first two years' average) | Long run (sample period average, 1975-76 to 1993-94) |
| Real Exports (US$) | 0.53 | 0.67 | 0.82 |
| Real Imports (Rs.) | 0.02 | 0.02 | -0.06 |
| Exchange Rate* | -0.09 | -0.13 | -0.59 |
| Current Account Deficit (Rs.)** | -5.90 | -8.69 | -8.86 |
| (as % of GDP) | (-0.03) | (-0.04) | (-0.08) |
| External Debt | -0.28 | 0.50 | -2.60 |
| External Interest Payments | — | -0.21 | -3.18 |
| Fiscal Deficit | -0.02 | -0.03 | -0.12 |
| Money Supply | -0.004 | -0.01 | -0.09 |
| Prices | 0.005 | -0.01 | -0.09 |
| Real Income | 0.01 | 0.02 | 0.02 |

* (+) Implies depreciation and (-) appreciation
** (+) Implies increase in deficit and (-) decrease

The immediate impact is an increase in dollar value of real exports of goods and services by 0.53 per cent over the reference simulation. Imports also rise by 0.02 per cent because of the higher level of domestic absorption. The current account deficit declines by 5.90 per cent in the first year implying an improvement

of 0.03 percentage point in relation to GDP, which brings down the stock of external debt by 0.28 per cent. The improvement in current account balance and consequent reduction in external debt although brings down the external interest payment in the subsequent years, this also creates the conditions for exchange rate appreciation. In the long run, the annual average rate of decline in the current account deficit is placed at 0.08 percentage point of GDP, over the base-year scenario.. The domestic impact of the favourable world output shock is an increase in real income which leads to an improvement in government resource gap and a decline in money supply and price level in the economy

## Section VI
## Concluding Observations

The major objective of this paper has been to analyse the various inter-relationships among fiscal deficit, prices, output and balance of payments and in this context to evaluate different policy options for maintaining sustainable internal and external balances in the economy. High levels of fiscal deficit pose various problems for the economy, inflation and adverse balance of payments consequences are considered to be the serious concerns of these deficits.

The macro econometric model presented above provides an integrated framework to study the external sector dimension of the fiscal deficit alongwith its monetary and real sector implications. The policy simulation results presented in the paper revealed that fiscal deficit in general results in widening of current account deficit, although this outcome critically depends on how the deficit is financed. In the case of monetary financing scenario, the price and income effects reinforce each other, leading to a rapid deterioration of external balance in the short run as well as in the long run. The external impacts of deficit are, however, less severe when deficit is financed by increased domestic savings. Thus, in any effort to maintain a sustainable balance of payments situation, domestic economic policy aimed at maintaining absorption and price at appropriate levels has an important role to play. This underlines the need for an externally consistent budgetary policy, keeping in view a medium term target of current account deficit in relation to GDP.

It is also important to observe that deficit financing to promote public investment and growth involves costs in terms of loss of control on inflation. The policy simulation results presented in the study show that a sustained increase in fiscal deficit financed by borrowing from the Reserve Bank leads to a spiral impact on prices in the long run although in the short run the adverse impact may look quite moderate. Even when the deficit is financed by borrowing from market, a prudent limit for such borrowing becomes essential. In a system of market determined interest rates, the financing requirement of government from the market should be consistent with the growth in national savings.

The policy simulation results also show that while growth in world income improves the external payments situation, some of the improvements may be lost due to the exchange rate appreciation. While a viable balance of payments strategy would have to be based on the supportive domestic policies to keep absorption and prices at appropriate levels, any temporary disequilibrium in the balance of payments due to adverse relative price movements may necessitate some adjustment of exchange rate.

## Notes

1. Fiscal deficit of the public sector in this analysis is taken as the saving and investment gap of public sector as measured in the National Accounts Statistics following the principles based on the **System of National Accounts** (SNA). This measure of fiscal deficit will not agree with the comprehensive public sector deficit computed from budget documents because of several accounting differences, such as the cash based accounting in budget *versus* accrual accounting in SNA, the difference in the consolidation of transactions and classification differences mainly arising from the treatment of acquisition of financial assets by the government (IMF, 1986).

2. This impact will not be strong if there are supply constraints or the economy is operating at near full capacity level.

3. The weighted average lending rate refers to the mean lending rates of commercial banks for various ranges of outstanding advances, weighted by the share of the respective outstanding advances to the total.

4. The net capital account transaction in the balance of payments is taken as a proxy for the private capital flows.

5. The increase in interest payment may be, to some extent, offset by higher profit transfers from RBI due to the rising share of RBI's claim on government in the total debt.

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## Table 1 : Complete Model Structure

| Behavioural Equations | $\bar{R}^2$ | DW | h | SEE | Mean |
|---|---|---|---|---|---|
| 1. Ln DT = -2.17137 + 0.316483 Ln ynar + 0.305434 Ln P<br>(-1.444) (1.042) (2.549)<br>+ 0.660085 Ln $DT_{(-1)}$ + 0.153704 $\overline{DDT}$<br>(4.749) (5.602) | 0.994 | — | 0.121 | 0.064 | 3.987 |
| 2. Ln DIT = -2.49598 + 0.346666 Ln y + 0.369602 Ln P<br>(-2.427) (2.073) (2.974)<br>+ 0.681725 Ln $DIT_{(-1)}$ - 0.065361 $\overline{DDIT}$<br>(6.469) (-4.08) | 0.999 | — | -1.334 | 0.025 | 5.265 |
| 3. NTX = -1.43496 + 0.016150 YM - 19.0084 $\overline{DNTX}$<br>(-0.679) (26.4495) (-4.109) | 0.971 | 1.441 | — | 6.172 | 40.724 |
| 4. Ln con = -2.28749 + 0.753424 Ln ym + 0.488608 Ln $con_{(-1)}$<br>(-3.984) (4.016) (3.642) | 0.985 | — | 3.876 | 0.054 | 5.169 |
| 5. Ln ΔTDBT = -0.175347 + 1.07725 Ln FD - 1.54867 $\overline{DDBT}$<br>(-0.603) (18.649) (-4.169) | 0.967 | 2.237 | — | 0.355 | 6.882 |
| 6. Ln ΔBCG = -3.30739 + 1.33101 Ln ΔDEP + 0.385007 $\overline{\Delta WSLR}$<br>(-6.516) (13.924) (2.287)<br>+ 1.07537 $\overline{DBCG}$<br>(4.131) | 0.930 | 2.089 | — | 0.354 | 3.065 |

**Table 1 : Complete Model Structure (Contd.)**

| Behavioural Equations | $\bar{R}^2$ | DW | h | SEE | Mean |
|---|---|---|---|---|---|
| 7. Ln DNB = -7.15106 + 1.44915 Ln Y - 0.498085 $\overline{DDNB}$<br>(-14.144) (20.438) (8.8603) | 0.972 | 0.53 | — | 0.209 | 3.662 |
| 8. Ln P = 2.40682 - 0.386965 Ln y + 0.253435 Ln $M_3$<br>(2.185) (-1.877) (3.524) | 0.997 | — | -0.93 | 0.030 | 4.74 |
| + 0.737810 $\overline{Ln\ P_{(-1)}}$ + 0.072752 $\overline{DP1}$ + 0.15342 $\overline{DP2}$<br>(7.797) (2.185) (5.892) | | | | | |
| 9. PGDP = -10.5967 + 1.16519 P<br>(-2.611) (49.526) | 0.998 | 1.617 | — | 2.538 | 141.039 |
| 10. PGKE = -18.3350 + 1.30327 P - 15.9699 $\overline{DPGKE}$<br>(-7.880) (76.324) (-4.080) | 0.997 | 1.834 | — | 5.068 | 143.939 |
| 11. ΔDEP = -1.11842 + 0.813803 $\Delta M_3$ + 8.2263 $\overline{DDEP}$<br>(-0.591) (111.228) (1.689) | 0.998 | 2.12 | — | 9.325 | 252.569 |
| 12. $M_3$ = -47.2778 + 3.19291 RM<br>(-2.715) (100.985) | 0.998 | 1.605 | — | 56.93 | 1239.48 |
| 13. IB = -42.9098 + 10.9017 Ln y -4.3318 Ln $m3_{(-1)}$<br>(-2.592) (2.546) (-1.863) | 0.648 | 1.77 | — | 0.70 | 8.886 |
| + 0.0681 $[(P - P_{(-1)}) / P_{(-1)}] \times 100$<br>(2.116) | | | | | |

## Table 1 : Complete Model Structure (Contd.)

| Behavioural Equations | $\bar{R}^2$ | DW | h | SEE | Mean |
|---|---|---|---|---|---|
| 14. Ln pc = 1.68639 + 0.615267 Ln pyd + 0.106510 Ln con<br>(3.468) (5.416) (1.855)<br>+ 0.072079 Ln P<br>(1.546) | 0.996 | 1.851 | — | 0.015 | 7.03 |
| 15. Ln piag = -3.05392 + 0.955718 Ln $yar_{(-1)}$<br>(-4.133) (8.261)<br>+ 0.210001 Ln $\overline{pcfag}$ - 0.167205 $\overline{dpiag1}$ + 0.165432 $\overline{dpiag2}$<br>(2.109) (-2.603) (2.714) | 0.799 | 1.031 | - | 0.095 | 3.439 |
| 16. pinag = 30.8012 + 0.253447 Δy + 0.372083 (Δbcp + $\overline{capb}$)<br>(1.936) (2.62106) (1.692)<br>- 1.42006 wlr - 0.485949 $pinag_{(-1)}$<br>(-2.168) (2.107) | 0.832 | — | -1.035 | 22.034 | 146.573 |
| 17. Ln yar = -7.13205 + 0.168682 Ln $\overline{RAIN}$ + 0.988747 Ln $\overline{AREA}$<br>(-3.968) (2.139) (3.425)<br>+ 1.23067 Ln $kagr_{(-1)}$<br>(6.421) | 0.772 | 1.799 | — | 0.036 | 6.252 |
| 18. Ln ynar = -2.09781 + 0.487659 Ln add<br>(-12.232) (7.93597)<br>+ 0.627139 Ln $knagr_{(-1)}$ + 0.04530 Ln $m3_{(-1)}$<br>(12.534) (2.058) | 0.999 | 1.930 | — | 0.001 | 6.819 |

**Table 1 : Complete Model Structure (Contd.)**

| | Behavioural Equations | $\bar{R}^2$ | DW | h | SEE | Mean |
|---|---|---|---|---|---|---|
| 19. | depag = -2.72953 + 0.050066 $kagr_{(-1)}$<br>(0.380) (4.728) | 0.52 | 1.983 | — | 4.64 | 28.64 |
| 20. | depnag = -40.1607 + 0.050198 $knagr_{(-1)}$<br>(-13.711) (58.510) | 0.994 | 2.05 | — | 4.18 | 134.203 |
| 21. | Ln expt$ = -1.26315 + 0.573835 Ln wyr<br>(-1.469) (2.417)<br>-0.319581 (PEXP$/WPEXP) + 0.569621 Ln $expt\$_{(-1)}$<br>(-3.343) (4.568)<br>+ 0.101755 $\overline{dexpt\$}$<br>(5.541) | 0.990 | — | -0.869 | 0.039 | 2.413 |
| 22. | Ln UVIX = -3.46657 + 0.158920 Ln P + 0.728536 Ln y<br>(-3.131) (1.319) (2.992)<br>+ 0.482021 Ln $UVIX_{(-1)}$ + 0.126679 $\overline{DUVIX}$<br>(4.95811) (6.5315) | 0.996 | — | -1.09 | 0.038 | 4.929 |
| 23. | Ln impt = -2.11530 + 0.641406 Ln ad - 0.462192 Ln $\overline{PIMP}$<br>(-2.858) (4.206) (-10.778)<br>+ 0.967421 Ln P - 0.110920 $\overline{dimpt1}$ - 0.182483 $\overline{dimpt2}$<br>(8.888) (-2.411) (-8.060) | 0.994 | 1.959 | — | 0.036 | 5.038 |

## Table 1 : Complete Model Structure (Contd.)

| | Behavioural Equations | $\bar{R}^2$ | DW | h | SEE | Mean |
|---|---|---|---|---|---|---|
| 24. | EXR = 5.92924 + 0.029026 P - 0.033261 CAB<br>(10.242) (3.897) (-4.655)<br>+ 0.059980 $\overline{\Delta RBFA}$ + 10.9361 $\overline{DEXR1}$ + 4.69085 $\overline{DEXR2}$<br>(11.336) (14.050) (5.596) | 0.991 | 2.126 | — | 0.639 | 12.843 |
| 25. | XII = 0.678411 + 0.037683 $\overline{RBFA}_{(-1)}$ + 0.176886 $\overline{LBR}$<br>(0.489) (5.526) (1.785) | 0.870 | 1.62 | — | 0.968 | 4.692 |
| 26. | ΔXDBT = 8.57517 - 1.35405 CAB + 0.610279 $\overline{\Delta RBFA}$<br>(1.304) (-13.669) (7.585)<br>+ 677.359 $\overline{DXDBT}$<br>(27.992) | 0.982 | 2.351 | — | 22.537 | 106.908 |

Note : (1) Exogenous variables are indicated by a line on top of the variable.
(2) Figures in brackets are 't' statistics.

## Table 1 : Complete Model Structure (Contd.)

### IDENTITIES

27. TR = DT + DIT + TM + NTX + $\overline{SE}$

28. TM = $\overline{MR}$ x [(impt x $\overline{PIMP}$)/ 100]

29. GXP = [(con x P)/100] + TRP + [($\overline{pcfag}$ + $\overline{pcfnag}$) x PGKE] x 100

30. TRP = IP + $\overline{SUBS}$ + $\overline{OCTR}$

31. IP = IPI + $IPX^g$

32. FD = GXP - TR

33. IPI = $\bar{I}_d$ x $IDBT_{(-1)}$

34. IDBT = TDBT – $XDBT^g$

35. $IPX^g$ = $\bar{I}^g_x$ x $XDBT^g_{(-1)}$

36. $XDBT^g$ = $XDBT^g_{(-1)}$ + $EB^g$ + $\overline{VLC}$

37. TDBT = $TDBT_{(-1)}$ + ΔTDBT

38. RCG = FD - ΔBCG - $\overline{\Delta FICG}$ – DNB - $EB^g$ - $\overline{MISCR}$ + $RCG_{(-1)}$

39. $EB^g$ = $\bar{E}$ x ΔTDBT

40. BCG = ΔBCG + $BCG_{(-1)}$

41. RM = RCG + $\overline{RBCS}$ + $\overline{RBFA}$ + $\overline{GCL}$ – $\overline{RNML}$

42. BCP = $M_3$ - RCG – BCG – $\overline{RBFA}$ – $\overline{OBFA}$ - $\overline{GCL}$ + $\overline{BNML}$

43. wlr = (IB + $\overline{OPC}$) - [(P - $P_{(-1)}$)/$P_{(-1)}$] x 100

44. absp = pc + piag + pinag

45. add = absp + con + $\overline{pcfag}$ + $\overline{pcfnag}$ + (expt$ x 7.91) - impt

46. ad = add + impt

47. y = yar + ynar

48. Y = (y x PGDP) / 100

49. YM = Y + DIT + TM – $\overline{SUBS}$

## Table 1 : Complete Model Structure (Concld,)

50. ym = (YM / PGDP) x 100

51. pyd = ym - [(TR/P) x 100] + [(TRP/P) x 100]

52. PEXPS = (UVIX x 7.91) / EXR

53. CAB = [(exp$ x UVIX x 7.91)/100] - [(impt x PIMP)/100] + (XII - XIP) + $\overline{NR}$

54. IPX = $IPX^g + IPX^p$

55. $IPX^p$ = $I_x^p$ x $XDBT^p_{(-1)}$

56. XDBT = $\Delta XDBT + XDBT_{(-1)}$

57. $XDBT^p$ = $XDBT - XDBT^g$

58. kagr = $\overline{pcfag} + piag - depag + kagr_{(-1)}$

59. knagr = $\overline{pcfnag} + pinag + \overline{erom} - depnag + knagr_{(-1)}$

Note : Exogenous variables are indicated by a line on the top of the variable

## Appendix 1 : Definition of variables

**Endogenous**

| | | |
|---|---|---|
| DT | = | Nominal direct tax revenue of government. |
| DIT | = | Nominal indirect tax revenue of government. |
| NTX | = | Nominal non-tax revenue of government administrative departments (includes income from property and entrepreneurship and miscellaneous current receipts). |
| con | = | Real government consumpiton expenditure. |
| ΔTDBT | = | Incremental debt of the government. |
| ΔBCG | = | Change in commercial bank credit to government (March 31). |
| DNB | = | Government domestic non-bank borrowing *viz.*, small savings, provident funds and special deposits etc. |
| P | = | Wholesale Price Index (1980-81 = 100). |
| PGDP | = | GDP deflator (1980-81 = 100). |
| PGKE | = | Implicit capital formation deflator in public sector (1980-81 = 100). |
| ΔDEP | = | Change in aggregate deposit of commercial banks, including co-operative banks (March 31). |
| $M_3$ | = | Broad money stock (March 31). |
| IB | = | Interest rate for 1 to 3 year bank deposits. |
| pc | = | Real private consumption expenditure. |
| piag | = | Real gross private investment in agriculture sector. |
| pinag | = | Real gross private investment in non-agriculture sector. |
| yar | = | Output originating from agriculture (1980-81 prices). |
| ynar | = | Output originating from non-agricultural sector (1980-81). |
| depag | = | Depreciation in agricultural sector in real term. |
| depnag | = | Depreciation in non-agriculture sector in real term. |
| expt$ | = | Exports of goods and services in constant US dollar (includes merchandise and invisible exports, excluding transfers, investment income and miscellaneous current receipts). |

| | | |
|---|---|---|
| UVIX | = | Unit value index of exports (1980-81 = 100). |
| impt | = | Real imports of goods and services in Rupees (includes merchandise and invisible imports, excluding transfers, investment income and miscellaneous current payments). |
| EXR | = | Nominal exchange rate (rupee to US dollar). |
| XII | = | External interest income in nominal term. |
| ΔXDBT | = | Change in external debt. |
| TR | = | Nominal current revenue of government. |
| TM | = | Nominal import tax revenue. |
| GXP | = | Nominal government expenditure. |
| TRP | = | Nominal transfer payments of government administration. |
| IP | = | Total interest payment of government. |
| FD | = | Public sector fiscal deficit. |
| IPI | = | Interest payment on internal debt of the government. |
| IDBT | = | Outstanding internal public debt. |
| $IPX^g$ | = | Interest payment on external debt of the government. |
| $XDBT^g$ | = | Outstanding external debt of the government. |
| TDBT | = | Total outstanding public debt of the government. |
| RCG | = | Outstanding Reserve Bank credit to the government (March 31). |
| $EB^g$ | = | External borrowing of the government. |
| BCG | = | Outstanding bank credit to the government (March 31). |
| RM | = | Outstanding reserve money (March 31). |
| BCP | = | Outstanding bank credit to private sector (March 31). |
| wlr | = | Weighted average real lending rate of banks. |
| absp | = | Real private absorption. |
| add | = | Real demand for domestically produced goods and services. |
| ad | = | Real aggregate absorption. |

| | | |
|---|---|---|
| y | = | Real GDP at factor cost. |
| Y | = | Nominal GDP at factor cost. |
| YM | = | Nominal GDP at market prices. |
| ym | = | Real GDP at market prices. |
| pyd | = | Real private disposable income. |
| PEXP$ | = | Index of dollar price of exports. |
| CAB | = | Current account balance. |
| IPX | = | Interest payment on external debt. |
| $IPX^p$ | = | Interest payment on private external debt. |
| XDBT | = | Outstanding external debt. |
| $XDBT^p$ | = | Outstanding private external debt. |
| kagr | = | Real net capital stock in agriculture sector. |
| knagr | = | Real net capital stock in non-agriculture sector. |

**Exogenous**

| | | |
|---|---|---|
| DDT | = | Dummy for 1991-92 for the change in the structure of direct taxes. |
| DDIT | = | Dummy for 1992-93 and 1993-94 for the sharp change in the indirect tax rates. |
| DNTX | = | Dummy for sharp fluctuations in non-tax revenue in some years. |
| DDBT | = | Dummy for sharp fluctuation in outstanding debt in 1974-75. |
| ΔWSLR | = | Weighted average statutory liquidity ratio (SLR weighted by the number of days the ratio was in force). |
| DBCG | = | Dummy for unusual increase in bank credit to government in 1977-78. |
| DDNB | = | Dummy for the sharp decline in government non-bank domestic borrowing in 1974-75. |
| DP1 | = | Dummy representing high inflation years in 1973-74 and 1974-75 due to first oil shock. |
| DP2 | = | Dummy for the second oil shock in 1979-80. |

| | | |
|---|---|---|
| DPGKE | = | Dummy for the sharp decline in implicit government capital formation deflator in 1980-81. |
| DDEP | = | Dummy for large variation in bank deposits in 1985-86 and 1986-87. |
| pcfag | = | Public sector gross investment in agiculture in real term. |
| dpiag1 | = | Dummy for the sharp decline in public investment in agriculture in certain years. |
| dpiag2 | = | Dummy for sharp increase in public investment in agriculture in certain years. |
| pcfnag | = | Public sector gross investment in non-agriculture sector in real term. |
| capb | = | Net capital account in the balance of payments account deflated by wholesale price index. |
| OPC | = | Intermediating cost of banks. |
| RAIN | = | Railfall index (1970-71 = 100). |
| AREA | = | Index of gross cropped area (1970-71 = 100). |
| wyr | = | Index of world output (1980-81 = 100). |
| WPEXP | = | World price of exports (1980-81 = 100). |
| dexpt$ | = | Dummy for unusual large variation in exports of goods and services in some years. |
| DUVIX | = | Dummy for unusual decline in unit value index of exports in some years. |
| PIMP | = | Unit value index of imports (1980-81 = 100). |
| dimpt1 | = | Dummy for a large fall in imports following the stabilisation programme in 1991-92. |
| dimpt2 | = | Dummy for sharp variation in imports in certain years. |
| RBFA | = | Stock of Reserve Bank's foreign asset (March 31). |
| DEXR1 | = | Dummy representing the readjustment of exchange rate of Rupee in 1991-92. |
| DEXR2 | = | Dummy representing a large depreciation of exchange rate of Rupee in 1992-93. |
| LBR | = | One year London Inter-Bank Offer Rate. |

DXDBT = Dummy for change in classification of external debt from 1991-92 onwards.

SE = Gross savings of departmental and non-departmental enterprises of the government.

MR = Average import duty rate.

SUBS = Subsidies in nominal term.

OCTR = Other current transfers of the government administration representing pension, etc.

$I_d$ = Average interest rate on government domestic debt.

$I_x^g$ = Average interest rate on government external debt.

VLC = Valuation change in government external debt.

FICG = Financial institutions' investment in government securities (outstanding).

E = Proportion of external borrowing in the total borrowing of the government.

MISCR = Miscellaneous capital receipts of government.

RBCS = Outstanding Reserve Bank credit to commercial sector (March 31).

GCL = Outstanding government currency liability (March 31).

RNML = Outstanding Reserve Bank's net non-monetary liability (March 31).

OBFA = Outstanding level of other banks' foreign assets.

BNML = Banking sectors' net non-monetary liability.

NR = Net external transfers in balance of payments including non-interest investment income and other miscellaneous current receipts.

$I_x^p$ = Average interest rate on private external debt.

EROM = Errors and ommissions in gross capital formation data.

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# Growth Cycles in India : An Empirical Investigation

**Himanshu Joshi***

An econometric analysis of growth cycles in India carried out in the present paper shows that the period of 1960-61 to 1994-95 can be broadly sub-divided into three phases. The first phase which extends from the early sixties to the late seventies can be recognized as a low growth era, followed by an edging up in the first half of eighties and a period of high trend growth (over 5 per cent per annum) beginning from 1985-86 and continuing till the end of the sample in 1994-95. The analysis of the relationship between cyclical components of monetary and aggregate demand variables with real growth reveals interesting results. While monetary surprises affect growth adversely, cyclical fluctuations in aggregate demand variables, except public investment and private consumption, have an insignificant effect on future growth. The study explains these results by suggesting that income effects arising out of monetary and investment demand fluctuations can, as in King (1982), possibly increase consumption and thus constrain future growth in output. The results also suggest the existence of strong positive contemporaneous effects of cyclical fluctuations in real private consumption on output growth; followed by its equally sharp future reversals due to capacity constraints. It is also found that cycles in agricultural growth have a favourable impact upon the performance of the rest of the economy. On the whole, the empirical results underscore the key role played by both private consumption and public investment demand in creating business cycles in India. From the policy point of view, a strategic reduction in private consumption (and hence an increase in private savings and thus investment rate) and an enhancement in the tempo of public investment need to be recognized as two important factors in improving the growth performance of the Indian economy.

## Introduction

Burns and Mitchell (1946) define growth cycles as a 'consensus among expansions in many economic activities, followed by similarly general recessions, contractions, and revivals'. The identification and measurement of such business cycles in economic systems has all along been an important area of inquiry in macroeconomic research. It is understood that business cycles originate as a result of cyclical

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or transitory fluctuations in economic time series which trigger a downturn (or upturn) in the underlying trend of a time series. In carefully distinguishing the concept of cycles, Beveridge and Nelson (1981) state that, for example, it is not always possible to point out a cyclical 'downturn' as one necessarily implying an immediate decline in the actual time series. However, since actual declines or increases in the series regularly follow the general direction of their preceding cyclical movements, it is well nigh possible to predict the movement of the underlying trend by studying the behavior of such cyclical components in real time. Thus, the mechanism of decomposition of a time series into its trend (or permanent) and cyclical (or transitory) components continues to receive keen attention in statistical analysis. Statistical decomposition methods, as opposed to some of the earlier methods focus more directly on a numerical measurement of business cycles. For instance, the National Bureau of Economic Research's (NBER) original tradition of classifying business cycles by identifying turning points and lead-lag relationships gave rise to a number of methodological controversies. The Bureau's methodology was also questioned by Koopmans (1947) from the standpoint that it took no account of economic theory. Since the appearance of the NBER work, the theories of business cycles and methods of measurement have progressed rapidly and acquired a certain degree of sophistication and rigor. In the literature, applications of business cycle models have been largely confined to developed economies which are supposed to be more susceptible to cyclical fluctuations. Less attention has, however, been accorded to developing countries which have experienced similar business fluctuations over the course of their development.

The aim of this paper is to attempt an empirical investigation of business cycles in India during the period 1960-61 to 1994-95 and to relate these developments to the estimated cyclical movements in a number of important macroeconomic variables in terms of their lead, lag or coincident characteristics. The paper is o rganized in three parts. Section I contains a review of the literature with a focus on empirical models and the course of research in the United States. Section II concerns with the discussion of the methodological aspects of the techniques currently employed

in empirical research. Section III offers an interpretation of the empirical results obtained for the Indian economy. Section IV presents concluding remarks.

## Section I
## A Brief Literature Review

Analysis of repeated and rapid fluctuations in aggregate economic variables around their long-term growth path has been a subject of immense interest in economic literature. While the reconciliation of these fluctuations with equilibrium theory formed a major challenge in the pre-Keynesian times, the Keynesian revolution turned the main attention towards obtaining solutions under disequilibrium situations arising as result of imperfect markets and coordination failures. The failure of the Keynesian theory in the 1970's, however, quickly turned the debate back into the new classical (or rational expectations) realm of equilibrium economics. The new classical macroeconomics since its inception in the early 1970's assumed rationality in decision making and thus always stressed on fully articulated equilibrium theories. Such an emphasis meant that real business fluctuations should not be explained by taking recourse to the arguments of market failures but that they be explained on the basis of the underlying costs associated with obtaining information and effecting an adjustment. Lucas (1972,1973), Sargent (1973) and Barro (1976), for instance, argue that real effects of monetary disturbances could arise from imperfect information about money and the general price level. These real effects arising from monetary disturbances could vanish in the long-run but could persist for a short period because of information lags and costs of adjusting the supply of labor and other quantities. The conceptual articulation of the belief, particularly, about the role of monetary surprises in producing real effects in an economy could not, however, withstand the body of controversial evidence in empirical research. While the predicted positive effect of monetary shocks on output and employment was found sensitive to changes in specification, the relation between price shocks and output and employment was found to be weak or nonexistent in the post World War II period in the US (Sargent, 1977; Fair, 1979). Due to these revela-

tions, the focus of business cycle research moved away from the emphasis on monetary shocks to those on real shocks. New real business cycle (RBC) models of the early 1980's highlighted real factors such as investment, consumption, capital stocks, productivity, working hours and technology in causing business cycles and argued that any evidence of positive correlations between output and money merely reflects the endogenous response of monetary aggregates to output growth. The equilibrium RBC models, however, differed from the classical equilibrium tradition in terms of their incorporation of a shock propagation mechanism generated by optimizing behavior of economic agents operating in a competitive environment. The return of the new classical economics at the centre stage has generally been welcomed by empirical analysts such as Hodrick and Prescott (1997) who state '....the search for an equilibrium model of the business cycle is only beginning and that studying the comovements of aggregate economic variables using an efficient, easily replicable technique that incorporates our prior knowledge about the economy will provide insights into the features of the economy that an equilibrium theory should incorporate'.

The classic research work on business cycles is the one by Burns and Mitchell (1946) who approached the problem of identification of US cycles through episodic dating. Their approach emphasized on the identification of turning points by tracking a cross section of economic indicators and dating the time when these indicators changed direction from positive to negative or *vice versa.* Subsequently, the NBER work on business cycles closely followed the methodology of Burns and Mitchell (1946) and persisted with the practice of identifying turning points and lead-lag relationship by means of an eyeballing process.

The business cycle chronology analysis of the US economy in the inter-War period (1918-1938) attempted by Burns and Mitchell is based on an analysis of hundreds of individual time series which shows that while the US economy suffered four recessions since the end of the second World War, these were relatively mild in nature. Since 1937, however, there occurred a total of five

recessions, the longest of which lasted barely thirteen months, thus underscoring the rather mild and brief nature of such contractions against the evidence available for the previous hundred years of the US economy. The empirical results produced by Burns and Mitchell did not go unchallenged but subsequent revaluation of the dates by the NBER staff led to a maximum of three changes out of twelve identified by them. The work of the later NBER researchers who devoted attention to the post-war period and followed the methodology of Burns and Mitchell was challenged by others mainly on methodological issues [Moore (1961), Trueblood (1961), Cloos (1963) and Zarnowitz (1963)].[1] Nonetheless, the NBER results were largely supported later by Stock and Watson (1989) through their empirical results based on a dynamic model with unobserved components.

The NBER dating method came under scrutiny both on conceptual and practical grounds. Conceptually, it was considered erroneous because a cyclical downturn did not imply an immediate decline in the actual series itself. In other words, if the underlying trend in the time series was strongly positive, then downturns in its cyclical components could occur without any negative change appearing in the series itself. From a practical standpoint, since the cyclical components usually precede the actual down (up) turns, it is considered more useful to attempt a numerical measurement of cyclical movements to provide an on-going record of cyclical movements as they develop over time for the purpose of an early detection of actual turning point(s) (Beveridge and Nelson, 1981).

While the main focus of the NBER business cycle research was on identifying turning points, further research on US business cycles addressed issues of the relative duration and volatility of business cycles during the pre and post war years. Beginning with a steady growth in the US economy since 1960, many researchers believed that the economy became more stable and less volatile in the post-war years as compared with that during the pre-war period (Baily, 1978, De Long and Summers, 1986). The general consensus on diminishing volatility was, however, challenged by Romer (1986, 1989) who attributed the observed differences in volatility in pre

and post-war to methodological problems. Romer's findings were yet again challenged by several researchers on grounds of ambiguity related to the construction of data series. The debate on duration, on the other hand, has displayed a large measure of agreement with the exception of the findings reported by Beveridge and Nelson. It is now generally recognized that the post-war US economy showed relatively longer expansions and shorter contractions, as supported by Diebold and Ruderbusch (1992) and more recently by Vilasuso (1996).[2]

## Section II
## Methodological Issues

The technological advancement in the statistical procedures meant for the measurement of business cycles has been quite rapid. In the number of technical methods developed to date, the key concern has been on improvising methods either to decompose a given time series into its trend and cyclical components or develop tests for clearly identifying the turning points. Of the earlier works, Fellner's (1956) decomposition approach was the most simple, as it was based on detrending of the concerned time series. The cyclical component was then obtained as a residual from the trend line. A major limitation of taking the trend line as the permanent component was that if the time series was indeed random, then the deviations from the trend were expected to grow unbounded and thus were capable of entirely distorting subsequent statistical inference. Nerlove (1967) approached the problem of decomposition via the method of signal extraction which implied *a priori* knowledge of the stochastic property of the unobserved components. Mintz (1969, 1972) characterises his business cycles on the basis of (i) deviation and (ii) step cycles. While the deviation cycle is defined as a residual from a centered seventy-five month moving average of the data, the step cycle concerns with the fluctuations in the rates of change of time series such that a 'downturn' is defined to be the endpoint of a period of relatively rapid growth and an 'upturn' as the endpoint of a period of relatively low growth. Two major problems with this approach are; the assumption of the same centered moving average for all series regardless of their stochastic

properties, and the unavailability of the future observations for inclusion in the average.

Among the more sophisticated methods, Beveridge and Nelson propose a time domain procedure in which a series is decomposed into its stochastic stationary (or cyclical) and non-stationary (or permanent) parts. The authors denote the cyclical component as the forecastable momentum of the series present at each time period but which is expected to dissipate as the series returns to its permanent level. The application of the method entails a detailed investigation of the stochastic structure of time series for designing appropriate filters. Since this technique employs past data alone and is simple to apply, it can be readily performed in real time to monitor business developments. The problems with this approach are twofold. First, since the construction of any ARIMA structure entails a measure of subjectivity, it is often questioned on the grounds of appropriateness. Secondly, this decomposition procedure implies a perfect correlation between the innovations in the trend and cyclical components and is thus entrenched on a rather restricted assumption that the trend in the series is always revised on the basis of current innovation.

Hodrick and Prescott propose a method of decomposition based on Whittaker-Henderson Type A filter in which a time series, recognized as composed of a smoothly varying trend component and a cyclical component, is split in its two characteristic components on the basis of some justifiable assumptions. In electing this particular approach, the authors mention that fluctuations in the post-war US economy are too rapid to be accounted for by slowly changing demographic and technological factors and changes in capital stocks that produce secular growth in per capita output. Moreover, they also argue that the lack of a prior knowledge about the exact stochastic structure of a time series implies that one cannot, perhaps, unequivocally separate the trend and cyclical components as, for instance, is done in case of the Beveridge and Nelson procedure. In view of these caveats, they propose a 'graduating' procedure based on the Whittaker-Henderson Type A filter which has been traditionally used in actuarial calculations and is more suited to

growth theory dynamics. The Hodrick and Prescott filter assumes that a time series can be represented as a smoothly varying growth component and a cyclical component which approaches zero on an average over a long time horizon. The Hodrick Prescott filter like other smoothing procedures also has its drawbacks, in particular, because of its sensitivity to cross-variable correlations.

Bowden (1972) employs spectral methods to obtain a measure of what is known as the 'spectral reference' cycle for a set of covariance-stationary time series. This procedure is based on the evidence of a dominance of estimated principal components in the spectral density matrix and uses corresponding loadings for constructing the reference cycle. While Bowden (op.cit.) assumed a one dimensional manifold, Sargent and Sims (1977) employed the technique of factor analysis in the frequency domain to develop a two index model assuming that an individual series could be driven by more than one factor. On the other hand, Martin (1987) applied the technique of canonical correlations in the frequency domain to a pre-existing classification of coincident and leading indicators for estimating optimum weights for each series to construct his reference indices. Bowden and Martin (1993) later argued that even though a spectral reference cycle is a useful device, it is more natural to think of a reference cycle in the time domain. This is because in terms of the study of lead and lags, frequency specific phase differences cannot be integrated over all frequency bands to derive a time domain estimate of the extent to which a constituent index leads, lags or is coincident with the aggregate cycle. In view of this difficulty, they suggest that a solution of the problem can be found by studying the duality aspects of reference cycles in time and frequency domains. They achieve this objective by doing a Fourier inversion of a spectral single index derived from a principal component analysis of the original spectral density matrix corresponding to a set of covariance stationary series. Applying this method to the Center for International Business Cycle Research (CIBCR) post-war data for the US economy, they indicate the existence of a reference cycle for the US and suggest that an international comparison of business cycles in terms of their national

coherence and lead-lag patterns could help in identifying international engines of growth.

In the present study the approach taken is that suggested by Hodrick and Prescott due to the plausibility of its underlying assumptions about the nature of growth of macroeconomic aggregates. In this method, a time series is represented as a sum of a growth and cyclical components :

$$y_t = g_t + c_t$$

where $y_t$ is the time series and $g_t$ and $c_t$ are its growth and cyclical components, respectively. Since the growth component is assumed to vary smoothly, the measure of smoothness is the sum of the squares of its second difference. The cyclical component is the deviation from the growth component which, on an average, tends to zero over a long time horizon. Accordingly, the following minimization program is proposed

$$\underset{\{gt\}^T_{t=-1}}{\text{Min}} \quad \{ \sum_{t=1}^{T} c_t^2 + \lambda \sum_{t=1}^{T} [(g_t - g_{t-1}) - (g_{t-1} - g_{t-2})]^2 \}$$

where $c_t = y_t - g_t$. The parameter $\lambda$ is a positive number called the smoothing parameter which penalizes the variability in the growth component series. In other words, the larger is this parameter, the smoother is the solution to the growth series. For very large $\lambda$, the solution of the minimization program is equivalent to a linear time trend regression.

The choice of the parameter $\lambda$ depends essentially upon the relative variations in the growth and the cyclical components. This is because if the cyclical and the second differences of the growth components were identically distributed normal variables with zero means and variances $\sigma_1^2$ and $\sigma_2^2$ then the conditional expectation of the $g_t$, given the observations on $y_t$, would provide the solution to the minimization program when $\sqrt{\lambda} = \sigma_1/\sigma_2$.

The minimization problem, given the value of the parameter $\lambda$, has a state space representation and can be solved by the method of Kalman Filter for estimating $g_t$. Alternatively, the criterion function can also be optimized by standard dynamic programming algorithm due to Bellman (1957). The Bellman principle of dynamic programming is essentially a type of solution to an optimal feedback control problem which is concerned with the determination of the best ways to achieve a set of objectives as indexed by a criterion (loss/ preference) function when the performance is judged over many periods and when the dynamic behavior of the system is subject to a set of given constraints (Chow, 1981). The mathematical structure of a typical linear quadratic control problem is as follows :

Consider a deterministic linear system

$$y_t = A\ y_{t-1} + B\ x_t + u_t \qquad \text{.....(1)}$$

with $y_t$ and $x_t$ as vectors of state and control variables, respectively, and matrices A and B of known constants which needs to be controlled in such a way as to minimize a typical loss function over a finite horizon. The standard loss function for the policy maker is quadratic and is represented as follows :

$$V_t = \sum_{t=1}^{T} (y_t - a_t)'\ K_t\ (y_t - a_t) \qquad \text{.....(2)}$$

in which $a_t$ is the vector of given targets, $K_t$ are known symmetric positive semi definite matrices.

The solution to this problem is obtained through backward induction. Specifically, if $V_t$ is the expectation of loss for period T based on the availability of information upto the period T-1, then it can be expanded and rewritten for time point T as follows

$$VT = E_{T-1}(y_T - a_T)'\ K_T(y_T - a_T) = E_{T-1}(y_T'\ H_{TyT} - 2y_T'\ h_T + c_T) \text{.....(3)}$$

where $K_T = H_T$, $K_T a_T = h_T$, and $c_T = a_T'\ K_T a_T$. On substituting (1)

above in (3) and minimizing with respect to the control vector $x_T$, the optimal policy for the last period turns out to be

$$\hat{x}_T = G_T\, y_T + g_T \qquad \text{.....(4)}$$

where

$$G_T = -\,(C'_T H_T C_T)^{-1} (C'_T H_T A_T) \qquad \text{.....(5)}$$

$$g_T = -\,(C'_T H_T C_T)^{-1} C'_T (H_T b_T - h_T) \qquad \text{.....(6)}$$

The minimum expected loss for time T is obtained by substituting $\hat{x}_T$ in $\hat{V}_T$. Next, in order to obtain optimal policies for the last two periods, we require to minimize the combined loss function written as the expected value of the sum of these functions for the last two periods *viz.*, time points T-1 and T. In this sum, the loss function included for time T is the one already minimized. Consequently, the expression to be optimized turns out to be

$$V_{T-1} = E_{T-2}\,[(y_{T-1}-a_{T-1})'\, K_{T-1}(y_{T-1}-a_{T-1}) + \hat{V}_T] \qquad \text{.....(7)}$$

$$= E_{T-2}\,(y_{T-1}\, H_{T-1}\, y'_{T-1} - 2y'_{T-1}\, h_{T-1} + c_{T-1}) \qquad \text{.....(8)}$$

with $H_{T-1}$, $h_{T-1}$ and $c_{T-1}$ defined appropriately after substituting for $\hat{V}_T$ in (7). The three period optimization is similarly executed

$$V_{T-2} = E_{T-3}\,[(y_{T-2}-a_{T-2})'\, K_{T-2}(y_{T-2} - a_{T-2}) + \hat{V}_{T-1}] \qquad \text{.....(9)}$$

and so on for the entire sample horizon. At the end of the process, the optimal control $x_1^*$ for t=1 is obtained as $x_1^* = G_1 y_0 + g_1$, where $y_0$ is the given initial parameter. Finally, the system equation (1), with the help of the feedback rule (4) can be integrated forward in time to obtain the entire set of optimal state and control vectors.

The problem posed by the Hodrick-Prescott filter is just the same as that posited by deterministic control mechanism wherein the

minimand is the loss function and the linear system is defined as $Y_t = AY_{t-1} + BX_t$, where $Y_t = (g_t, g_{t-1}, 1)'$ and $X_t = [(g_t - g_{t-1}) - (g_{t-1} - g_{t-2})]$ and A and B are known matrices with $g_t$, as defined earlier, is the growth component of the time series in question with $g_T$ and $g_{T-1}$ as free initial parameters. Consequently, the same order of steps can be applied to estimate the optimal control vector in terms of the growth component.

In solving the problem, as far as the *a priori* selection of the value for the known parameter $\lambda$ is concerned, we choose a smaller value of 100.0 which implies that variability of the growth component is not too small in comparison with that of the cyclical component in each of the series in question. This assumption of a lower value for $\lambda$ as against the usual value of 1600 is verified on the basis of the empirical measures of dispersion of the series selected for analysis. However, it must be mentioned that the empirical analyses elsewhere has shown that the results are often not very sensitive to moderate changes in the value of $\lambda$. Hodrick and Prescott, for instance, show that the solution changes vary little if $\lambda$ is either reduced by a factor of 4 to 400 or increased by a factor of 4 to 6,400. Results, however, change a lot if the value of $\lambda$ is increased by a very large factor approaching infinity. With this brief introduction to the decomposition method due to Hodrick and Prescott, the following section presents the empirical estimates of the model in the Indian context.

## Section III
## Evidence in the Indian Context

In seeking to study business cycles in India, it is proposed to analyze the cyclical properties of monetary, fiscal and real variables and their interrelationships with real growth in the economy. In the monetary sector, the variables considered are the stock of real narrow money balances ($M_1$) and broad money balances ($M_3$). In the fiscal sector real public expenditure (consumption and capital) is taken as the relevant variable. The real factors are represented by real values of aggregate and private corporate investment, private consumption and capital stock.[3] In this choice of variables,

investment, consumption and Government expenditure may be viewed as components of real aggregate demand in the economy. Apart from these variables, an attempt has also been made to review the interrelationships between cyclical fluctuations in agricultural incomes and non-agricultural growth. The sample period of analysis relates to 1960-61 to 1994-95. Table 1 presents the statistical properties of the data used in the study. Statistics in Table 1 essentially suggest that investment and capital stock variables are relatively more variable as compared with other variables.

The statistics pertaining to real GDP growth, especially, its standard deviation suggests that the series is reasonably volatile for enabling an analysis of business cycles in the Indian economy. Moreover, since most of the other variables are also seen to fluctuate significantly in terms of spread around their respective means, their cyclical components can also be derived to study their association with the variations in the rate of growth of real output.

In studying business cycles, we follow the functional specification of Hodrick and Prescott who propose the following form with K as the maximum order of lags

$$(3)\quad c_{jt} = \alpha j + \sum_{i=-K}^{K} \beta_{ji}\, GDP_{t-i}$$

However, in deviating from the specification above, we regress cyclical components $c_{jt}$ with the growth rate of real GDP which is also stationary. The transformation of real GDP variable was undertaken to maintain consistency in time series properties of the data employed in the regressions and for achieving robust empirical results. Table 2 presents estimated regressions of the form suggested above.

**Table 1 : The Statistical Profile of Indian Data**

| Variable | Correlation with real GDP growth | Standard Deviation |
|---|---|---|
| (1) | (2) | (3) |
| Real GDP | — | 3.44 (4.27) |
| Real agriculture output | 0.93 | 6.56 (2.80) |
| Real non-agriculture output | 0.66 | 2.12 (5.38) |
| Real $M_1$ | 0.22 | 5.82 (4.69) |
| Real $M_3$ | 0.22 | 6.08 (6.65) |
| Real total Investment | 0.36 | 10.55 (5.90) |
| Real Capital Stock | 0.32 | 16.97 (5.82) |
| Real Public capital formation | 0.15 | 10.90 (4.97) |
| Real Private Investment | 0.16 | 36.61 (11.93) |
| Real private consumption | 0.88 | 2.39 (3.69) |
| Real public consumption | -0.01 | 5.53 (6.51) |

Notes : (i) The statistics pertain to the annual growth rates of the variables listed in column one.
(ii) Figures in brackets in column (3) are the respective mean growth rates over the sample under consideration.

Graph I presents the plots of the actual annual growth rate of GDP and its corresponding smoothed growth component derived from Hodrick-Prescott filter method. The estimates of the growth rate computed from the smoothed GDP series shows the trend growth of 3.21 per cent in 1965-66 compared to the actual negative growth of minus 3.65 per cent in the same year. The highest trend growth rate of 5.62 per cent was recorded in 1988-89 as compared to the actual growth of about 10.65 per cent during the same year. As suggested by the smoothed estimates, the first half

of the 'seventies saw an acceleration which began in 1972-73 and continued upto 1978-79. Thereafter, a continuous acceleration in the trend was recorded upto 1990-91, followed by the signs of minor deceleration till the end of the sample period in 1994-95. Incidentally, this period also coincided with the period of structural reforms in the economy. The differences between the actual and trend growth rates during the 1990's, especially after 1992-93 suggests the presence of cyclical influences on growth. Over the sample as a whole, the average smoothed annual growth rate estimated at 4.20 per cent does not seem to be very different from the actual growth rate of 4.27 per cent.

Turning to the empirical results presented in Table 2, the first two rows corresponding to the equation for real cyclical M1 and M3 which possess reasonable explanatory powers, suggest that monetary surprises do have adverse implications for real GDP growth.[5] This is akin to the results obtained by King who proves that if agents' preferences are time separable, then positive monetary surprises can produce strong income effects through illusory asset valuations and increase in marginal value product of capital resulting into an increase in both consumption and leisure and a decline in future work effort and production.

Rows 3 to 6 of Table 2 report estimated relationships between cyclical components of total investment, capital stock, public investment and private investment with the growth in real GDP. The explanatory power of the total and private corporate investment equations is not as good as those of the others. Moreover, the results indicate that cyclical disturbances in aggregate investment, capital stock and private corporate investment do not exert any significant effect on real growth, thus pointing towards their rather limited role in explaining business cycles in India. Moreover, the signs on the coefficients of future GDP growth in these equations are negative although insignificant. Interesting results are, however, observed in case of public investment. Cyclical variations in public investment are positively and significantly related to the second future lag of real GDP growth, even though, the first future lag has a negative but weakly significant coefficient. In view of the significant effects

of public investment cycles on future growth, it can be considered as a leading indicator for the purpose of classification. The empirical estimates also suggest that positive cyclical fluctuations in public investment are induced by past growth conditions implying that output growth has a favourable impact on public investment. Graph II provides the plots of cycles in public investment and the actual growth in real GDP, and suggests that public investment cycles lead output growth.

Of all the regressions, the one relating to private consumption explains about 78 per cent of the variation in output growth. The dynamic structure of this equation is also interesting insofar as the significance of the coefficients on leads and lags of real GDP growth are concerned. While rising real GDP growth is strongly and positively correlated with contemporary cyclical fluctuations in private consumption, the nature of the relationship is clearly reversed for leads in GDP growth. Such a result underscores the important effect of cycles in private consumption on the real growth. The negative impact of cyclical fluctuations of private consumption on future growth highlights the savings constraints of the economy and the limitations of the capacity in responding to ever increasing demand for consumption. This fact is borne out by Graph III which presents the plots of cycles in private consumption against the actual growth in output.

It is commonly understood that agricultural growth plays a vital role in stimulating the tempo of non-agricultural growth by creating sizable demand effects. In order to understand this intersectoral relationship, a regression similar to the types reported in Table 2, was estimated. Empirical results suggest that cyclical disturbances in agricultural income are positively and significantly associated with the growth in non-agricultural output.[6] Graph IV presents the plot of these two series which exhibits the close comovements between them.

## Table 2 : Cyclical Fluctuations and GDP Growth

*Regressors: lags of GDP growth (%)*

| Regrassand | Grow {t+2} | Grow {t+1} | Grow {t} | Grow {t-1} | Grow {t-2} | Rsquar | SEE | Box(Q) |
|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| cymn1 | -0.06 | -0.71* | -0.47 | 0.19 | 0.41 | 0.60 | 0.05 | 18.08 |
| | (-0.22) | (-2.71) | (-1.65) | (0.73) | (1.71) | | | |
| cymn3 | 0.01 | -0.57 | -0.24 | 0.28 | 0.49 | 0.53 | 0.04 | 17.85 |
| | (0.03) | (-1.91) | (-0.74) | (0.92) | (1.83) | | | |
| cyinv | 0.36 | -0.74 | 0.23 | -0.08 | 0.58 | 0.32 | 0.08 | 9.85 |
| | (0.70) | (-1.42) | (0.41) | (-0.71) | (1.19) | | | |
| cycap | 0.037 | -0.04 | -0.05 | -0.06 | -0.02 | 0.60 | 0.006 | 13.81 |
| | (0.94) | (-1.10) | (-1.02) | (-1.38) | (-0.61) | | | |
| cypub | 0.91* | -0.72 | -0.24 | 0.78 | 0.38 | 0.65 | 0.06 | 3.16 |
| | (2.39) | (-1.78) | (-0.53) | (1.89) | (1.05) | | | |
| cypvtcp | -1.08 | -0.99 | -0.59 | 0.24 | -1.59 | 0.14 | 0.25 | 11.45 |
| | (-0.66) | (-0.64) | (-0.36) | (0.15) | (-1.04) | | | |
| cypvt | -0.11 | -0.26* | 0.23* | 0.09 | 0.02 | 0.78 | 0.01 | 2.89 |
| | (-1.81) | (-4.05) | (3.19) | (1.37) | (0.45) | | | |
| cygov | 0.23 | -0.14 | -0.05 | 0.16 | 0.43* | 0.62 | 0.03 | 17.07 |
| | (1.20) | (-0.67) | (-0.20) | (0.76) | (2.36) | | | |

Notes to Table 2:

(i) The dependent variable 'Grow' is real growth rate while independent variables mentioned in column 1 are the cyclical components defined as follows : 'cymn1' for M1; (ii) 'cymn3' for M3; (iii) 'cyinv' for total investment (iv) 'cycap' for capital stock; (v) 'cypub' for public capital formation; (vi) 'cypvtcp' for private corporate investment (vii) 'cypvt' for private consumption; and (viii) 'cygovt' is for public or Government consumption.

(ii) Figures in brackets in columns 2 through 6 are t-statistics.

(iii) Each equation was run with a constant term and corrected for autocorrelation. All cyclical components are stationary as required by theory.[4]

## Section IV
## Conclusions

The empirical evidence presented in this study suggests a possible classification of main macroeconomic indicators in terms of their coincident and/or lead-lag relationships with real output. The results obtained in the study point towards significantly negative impact of monetary surprises on real GDP growth.[7] The cyclical fluctuations in public investment affect the future output positively and significantly with a lag. Contrary to expectations, cyclical variations in total investment or private corporate investment have an insignificant impact on future real growth.

The evidence reported in the present study also establishes the existence of a link between private consumption and growth. Cycles in private consumption are positively and significantly correlated with contemporaneous output growth thus underscoring its *primarily demand* generating impact on economic growth. However, the effect of cyclical changes in private consumption on future output growth is significantly adverse. From a policy point of view, this reflects the dominant effect of savings constraints on the economy's capacity to grow. While higher private consumption may be desirable from the standpoint of generating a demand impact in the economy in the current period, at the same time, it constrains the overall savings capacity of the economy in the long-run and affects the output growth adversely. The empirical results also suggest that cycles in Government consumption are too weak to impart any significant momentum to real growth, even though these cycles are significantly induced by previous changes in the rate of growth. Finally, the results also indicate that cyclical changes in agricultural growth have a positive and significant impact on the growth of output in the non-agricultural sector.

## Endnotes

1. Eventhough the NBER results were empirically challenged, an alternative analysis conducted by Cloos (op.cit.) could only find little changes in the results reported by the NBER. Beveridge and Nelson (op.cit.), however, report that measured post-war US expansions and contractions were roughly of the same duration in contrast to the NBER findings that contractions were of relatively short duration.

2. Both Diebold and Ruderbusch (op.cit) and Vilasuso (op.cit) employ non-parametric tests to study duration comparisons. While the former use Wilcoxin test, the latter employs change-point tests developed by Lombard (1987). Results reported by Vilasuso indicate that while the conclusion remains the same, there is, however, a specific change in the nature of results. For example, an abrupt shift in the duration of expansions took place since 1929, wherefore average expansions were found to be have been doubled in duration along with a tendency for shorter contractions beginning 1918.

3. The data employed in the present work is from various issues of the National Accounts Statistics (NAS) published by the Central Statistical Organization and the Report on Currency and Finance of the Reserve Bank of India. The data on average monetary aggregates is deflated with WPI (all commodities). Total investment is gross domestic capital formation at constant 1980-81 prices from NAS as are other variables esp., total capital stock, public sector capital formation, private and public (government) consumption. Since the data on public sector capital formation was not available in real terms for the early part of the sample (up to 1979-80), we have taken the approach of Ray (1997, footnote 32) in generating the requisite series.

4. The following are the Phillips-Perron unit root statistics for the estimated cyclical components. (i) real GDP = -5.13; (ii) real M1 = -3.39; (iii) real M3 = -3.37; (iv) real total investment = -4.84; (v) real capital stock = -6.12; (vi) real public capital formation = -4.57; (v) real private consumption -5.53; (vi) real public consumption = -3.59; (vii) real private corporate investment. -4.76; (viii) real agricultural output = -5.34. Given these estimated statistics, all of them are stationary if compared with the 5% critical value of -2.89.

5. This is because in both the cases, the first future lag of real GDP growth is negatively and significantly related to monetary cycles. The interpretation is, however, different from that of Barro (op.cit.) who argues that if nominal disturbances are mistakenly perceived as representing shifts in intertemporal relative prices, then such shocks are neutral towards output. On the other hand, Lucas (op.cit.) argues that if each economic agent produces and consumes in only one of the many decentralized markets, while no one directly observes nominal aggregates or general price level, then the basic equilibrium model can rationalize a positive association between money, output and the price level. In a cross section empirical study of eleven countries (including developed and less developed Latin American counties) Attfield and Duck (1983) show that monetary surprises have a positive effect on real output.

6. The estimated equation for the period 1961 to 1995 is as following:

$$\text{nonagr}_t = \underset{(9.57)}{0.049} + \underset{(0.50)}{0.04\ \text{cyagr}\{-2\}} + \underset{(0.70)}{0.05\ \text{cyagr}\{-1\}} + \underset{(2.83)}{0.23\ \text{cyagr}_t}$$

$$\underset{(0.37)}{+0.03\ \text{cyagr}\{1\}} - \underset{(-0.64)}{0.05\ \text{cyagr}\{2\}}$$

*Rsquare = 0.44; SEE = 0.02; Box (Q) = 4.83*

where cyagr is the cyclical component of agricultural income and nonagr is the non-agricultural output. A negative lag implies a lead and vice versa.

7. Monetary surprises by affecting prices usually in the same direction can have an adverse implications for real growth. The impact of unanticipated inflation on growth was analyzed in Joshi and Ray (1996) wherein the relationship between the two was found to be negative.

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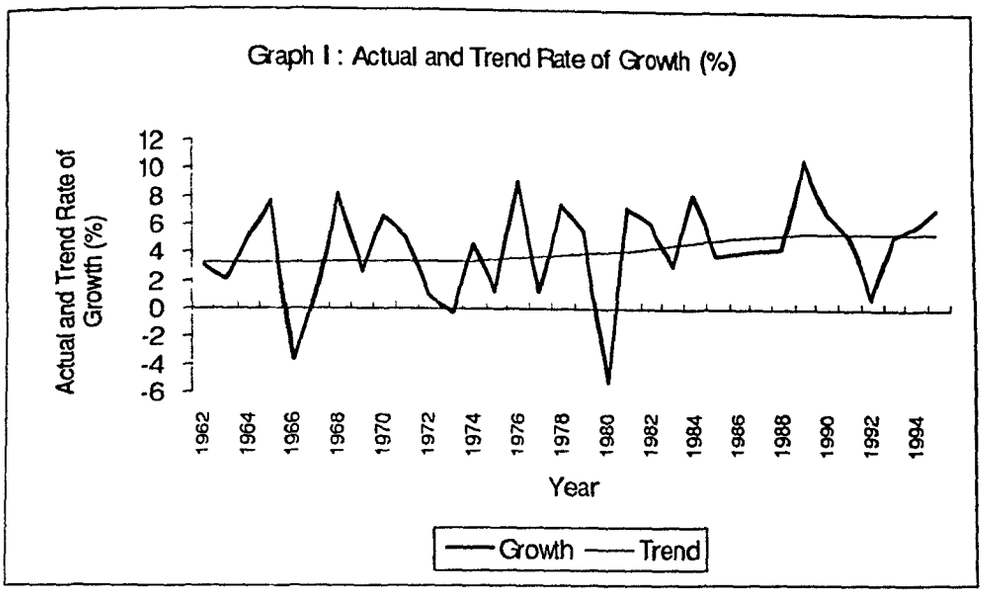
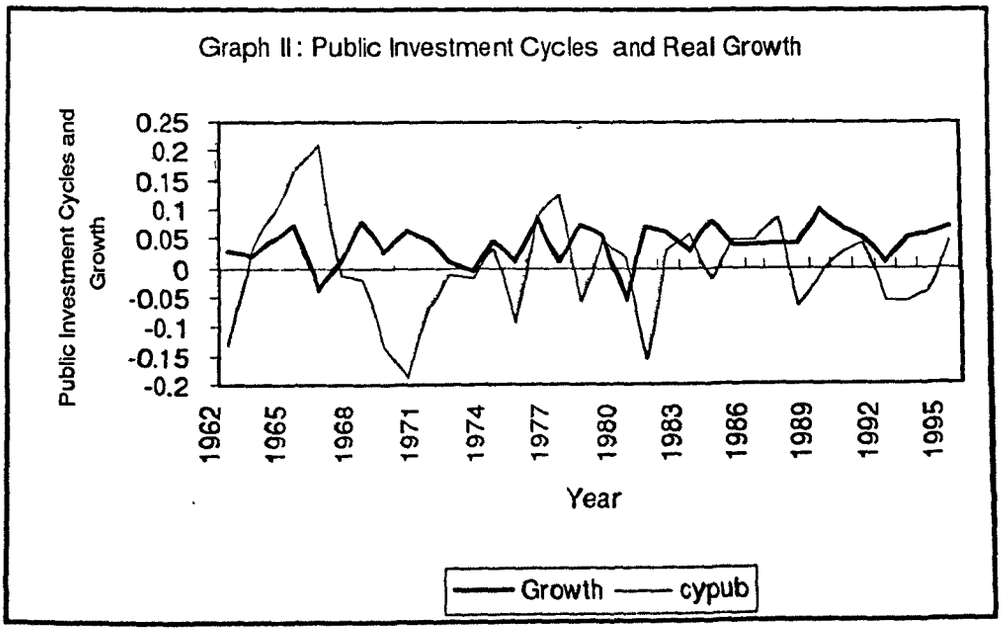
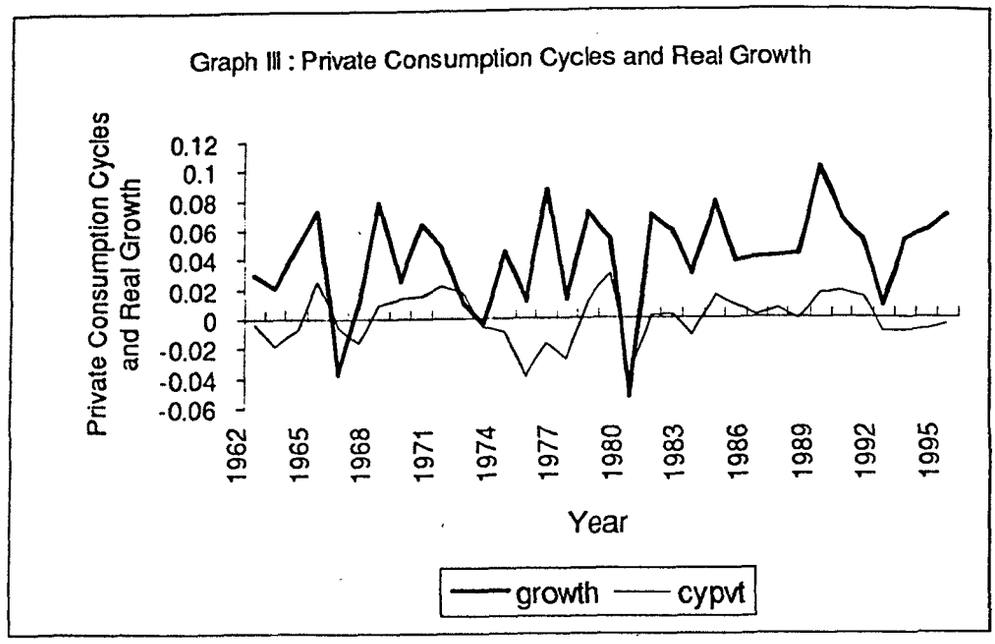
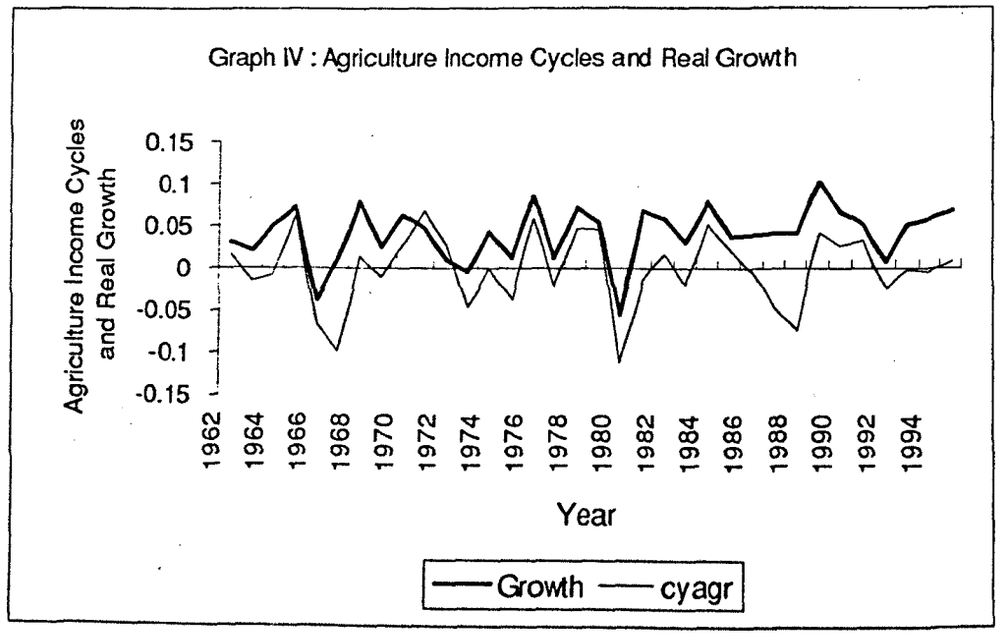

Graph I : Actual and Trend Rate of Growth (%)
Actual and Trend Rate of Growth (%)
12
10
8
6
4
2
0
-2
-4
-6
1962
1964
1966
1968
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
Year
Growth
Trend


Graph II : Public Investment Cycles and Real Growth
Public Investment Cycles and Growth
0.25
0.2
0.15
0.1
0.05
0
-0.05
-0.1
-0.15
-0.2
1962
1965
1968
1971
1974
1977
1980
1983
1986
1989
1992
1995
Year
Growth
cypub


Graph III : Private Consumption Cycles and Real Growth
Private Consumption Cycles and Real Growth
0.12
0.1
0.08
0.06
0.04
0.02
0
-0.02
-0.04
-0.06
1962
1965
1968
1971
1974
1977
1980
1983
1986
1989
1992
1995
Year
growth
cypvt


Graph IV : Agriculture Income Cycles and Real Growth
Agriculture Income Cycles and Real Growth
0.15
0.1
0.05
0
-0.05
-0.1
-0.15
1962
1964
1966
1968
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
Year
Growth
cyagr

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# Development of Composite Index of Banking Efficiency : The Indian Case

**P.C. Sarker & Abhiman Das***

With the changing scenario of the banking industry in the liberalised era, the importance of improved efficiency has assumed a critical significance for the viability of commercial banks operating in India. The present study examines the inter-bank performance differences in the efficiency of banking sector with respect to profitability, productivity and financial management for the year 1994-95. For each of the performance criteria, area-specific efficiency index has been worked out based on 15 indicators, using principal component analysis. The results show that there is a wide variation in efficiency among the banks according to their ownership pattern. The performance of public sector banks was relatively poor compared to other bank-groups. While a wide variation of performance among the foreign banks was discernible, the public sector banks resembled more or less a homogeneous group.

## Introduction

The banking sector in India has undergone a metamorphic change over the past three decades since nationalisation. In particular, the years following financial sector reform have witnessed significant changes in the structure and operation of the banking industry. While the liberalisation of the banking sector has brought opportunities for banks to expand their scope of operation, it has also introduced new uncertainties and risks in their business operations. The measures such as imposition of prudential norms, strengthening of supervisory system, liberalisation of interest rate and new competitive environment have brought about a significant

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change in the banks' attitude towards productivity, profitability and risk. Because of the changing competitive environment, the importance of improved efficiency has assumed a critical significance for the survival and sustained viability of commercial banks in India (Swami and Subrahmanyam, 1993). The focus of this paper is, therefore, to examine whether any change has taken place in the efficiency of the banking sector with regard to productivity, profitability and financial management. In order to judge the inter-bank relative performance of the banking industry, it will be of immense interest to identify the relative position of a particular bank in the industry as a whole on the basis of some of the performance criteria.

The paper is divided into five sections. Section I provides a brief outline of the available studies in India while Section II deals with the methodology adopted in the study. A discussion on the sources and limitations of data is given in Section III, whereas the results of the empirical analysis are presented in Section IV. Section V includes the concluding observations of the paper.

## Section I
## A Review of Literature

There already exists a copious amount of literature on the efficiency aspect of banking industry. Some of the notable studies in Indian context are Divatia and Venkatachalam (1978), Raghupathy (1979), Seshadri (1980), Karkal (1982), Angadi (1983 and 1987), Ojha (1987), Swami and Subrahmanyam (1993) and Hansda (1995). After nationalisation of major banks in 1969, there was a growing concern of deterioration of banking sector's efficiency in several spheres. In response to this, the Reserve Bank of India constituted a number of committees, notably Tandon Committee (1975), Luther Committee (1977), Chakravarty Committee (1986) and Narasimham Committee (1991) to examine the problem of declining efficiency of the financial sector in India. Luther Committee (1977) examined the productivity, efficiency and profitability of nationalised banks for the period 1969 to 1975 on the basis of a selected set of efficiency indicators, while Chakravarty Committee (1986) reviewed the mon-

etary system and suggested measures to improve the effectiveness of monetary policy in India. Narasimham Committee (1991) examined the financial system as a whole in the light of liberalisation of the economy. An important objective of the financial sector reform has been to create an environment that encourages competition within the banking sector by injecting a greater role of the private sector in the banking industry and reorienting the policy conditions facing the banking system. The most important set of recommendations of the committee dealt with the need for greater degree of operational flexibility and internal autonomy to the banks and financial institutions in carrying out their business.

Following the concept of operational efficiency as indicated in Luther Committee (1977), Divatia and Venkatachalam (1978) constructed composite indices using factor analysis to measure the individual bank's performance *vis-a-vis* the industry. Their study was confined to fifteen public sector banks and efficiency indices were compiled separately for productivity, profitability and social objectives using a total of eighteen indicators. It was observed that banks differed significantly in ranking positions in terms of productivity, profitability and social obligation criteria. The study did not, however, spell out the methodology followed for deriving factor loadings[1] and the computational procedures involved.

Swami and Subrahmayam (1993) developed composite index of performance of banks using 'taxonomic' method for combining certain indicators of income and expense. The study suffered from the major limitations of taxonomic method, which is based on assigning equal weights to all variables. Although it did correct for this limitation to some extent, the bias nevertheless persisted on the results reported.

Hansda (1995) constructed 'composite index' to judge the relative performance of 28 public sector banks for three years in the post-liberalisation period from 1991-92 to 1993-94. His study considered 25 indicators under five categories *viz.* labour productivity, branch productivity, financial management, profitability and growth. The methodology used was principal component analysis.

Seshadri (1980) carried out an econometric analysis of profitability in commercial banks and advocated against the indiscriminate expansion of banking facility in rural areas. Karkal (1982) found that the percentage of number of profit-making branches in rural areas increased over time in the case of public sector banks from 1976 to 1978, while it declined in the case of urban and metropolitan branches.

Angadi (1983) examined the commercial banks' efficiency by relating operating costs to output. The output generated by banks was measured by aggregate deposits and the total number of deposit accounts, total credit and the number of credit accounts and also the number of branches opened during the relevant period. The responsiveness of operating cost to output changes was taken as a measure of operational efficiency. Angadi (1987) analysed the accounting profit and economic profit of 28 public sector banks over a period of more than two decades. While calculating economic profit, only opportunity cost was deducted from accounting profit. He found that accounting profitability of Indian scheduled banks as a whole was deteriorating since 1965. However, divergent trends in profitability were observed between state bank group and nationalised banks group since 1974. The operating earnings for 19 banks declined considerably. Similarly, economic profit of as many as 14 public sector banks was negative in 1985.

The objective of the present study is to extend the analysis of efficiency measurement of banking industry by correcting some of the shortcomings of other studies in the area of coverage, methodology and interpretation of results. At the outset it is important to differentiate the conditions that lead to variations of performance among banks in the industry. Some conditions are internal to the banking firms, while some others are external. It is the internal conditions such as the management technique, organisation of production activities, etc., which lead to differences in efficiency and these conditions are within the control of the banks. External conditions refer to the policy environment which are different for different bank groups, such as the rural concentration of the public sector banks as against fairly high urban concentration of foreign

banks. The productivity differences are apparent because of the non-comparable position of different bank groups. Thus, it is expected that there would be differences in the efficiency performance among foreign banks, public sector banks and Indian private banks. As such, the banks operating in different environment are not exactly comparable. With this limitation, the study attempts to find out the relative positions of various banks operating in India according to different measures of efficiency. An index of efficiency has been constructed based on some major indicators of productivity, profitability and financial management. The specific-area level efficiency has been estimated first and then an overall index of efficiency has been worked out based on all the selected indicators[2].

## Section II
## Methodology

The methodology adopted in the study refers to the composite index analysis which has become a special branch of multivariate analysis of data. It is well known that the purpose of the multivariate analysis is "to summarize a large body of data by means of relatively few parameters" {Chatfield & Collins (1980), P.7}. A composite index of a set of variables can be constructed by following a wide variety of multivariate techniques. The choice of the most appropriate technique depends upon the type of the problem studied, the nature of the data and the objective of the analysis.

While a composite index can be constructed by using simple techniques like ranking and indexing, these techniques however suffer from several drawbacks [Dandekar Committee (1984), Kundu and Raza (1982) and Sarker (1995)]. The main drawbacks relate to the arbitrariness involved in the allocation of weights. Kendall (1939) developed a composite index formula to overcome these problems using inter-dependent variables pertaining to agricultural productivity, which is formally equivalent to what Hotelling (1933) called as a 'first principal component'. Subsequently, many have used principal component analysis and its equivalent technique 'factor analysis'. There are, however, some advantages of the 'principal component analysis' over the 'factor analysis' [Chatfield and Collins

(1980), Hills (1977) and Sarker (1995)]. In principal component analysis (PCA), a set of original variables is transformed to a new set of uncorrelated variables called principal components. These new variables are linear functions of the original variables and derived in decreasing order of importance. The objective is to find out only a few components which account for most of the variation in the original set of data.

It is important to note that the principal components of a set of variables depend critically upon the scales used to measure the variables. This scaling procedure is arbitrary and data dependent. But if all the variables are of equal importance, then the variables have to be scaled in such a way that they have unit variance. According to Chatfield and Collins (1980), "because of this, there is generally thought to be little point in carrying out a PCA unless the variables have roughly similar variances" (p.70). Thus, the conventional way of getting unit variance is either to standardise the variables (i.e. subtract the mean and then divide by standard deviation) or simply to divide by standard deviation. In other words, the problem is to analyse the correlation matrix rather than the covariance matrix. Chatfield and Collins (1980) suggest that "if the variables are not thought to be of equal importance, then the analysis of the correlation matrix is not recommended" (p.71). Similarly, Kundu and Raza (1980) suggested not using variables having unit variance where the main purpose is to analyse the disparity among the units. Instead, they opined for scaling the variables using their means.

The aim of the present study is to develop a composite index rather than to study the disparities among the banks. It is, therefore, appropriate to base the analysis on the correlation matrix. Thus, we have scaled the variables by normal standardising procedure i.e. $(x-\bar{x})/s$, where $\bar{x}$ and s are the mean and standard deviation of the variable x, respectively.

The efficiency indices for each area i.e. profitability, productivity and financial management have been compiled and discussed in Section IV. Besides, overall efficiency index has been compiled by

taking into account all the 15 indicators using PCA. Using the ranking method for area-efficiency indicators, ultimate ranking for each bank has also been attempted. The bank having the highest value of area efficiency is allotted the first rank. The ranks have been considered as cardinal numbers and the ultimate rank given to a bank is based on the arithmetic total of ranks obtained by it in different spheres. Though Kendall (1939) as one of the earliest users of ranking method adopted the average of the total ranks of all indicators as the ranking coefficient/index for a unit/region, in this exercise, 'total ranks' has been considered as a performance index. The procedure for adding the ranks is best known as Borda Rule or Borda score/index {Dasgupta (1990) and Das (1992)}. The lowest value of the 'total ranks' indicates the highest level of efficiency.

## Section III
## Efficiency Criteria

Based on the available data, a total of fifteen indicators pertaining to the measures of productivity, profitability and financial management have been considered in the study. Profitability criterion has been represented by 'net' instead of 'gross' profit since net profits account for provisions for non-performing assets (NPA). The relative profitability of a bank is expressed as the ratio of net profit to total income, deposits and spread. The usual indicators pertaining to branch productivity such as 'deposits per branch', 'credit per branch', etc., have been left out as these may introduce some upward bias in favour of foreign banks and some private sector banks, which have relatively large concentration in urban centres than the public sector banks. Productivity per employee has been taken to represent the overall productivity condition of the banks. The selected indicators of labour productivity are 'advances per employee', 'deposits per employee', 'income per employee' and 'spread per employee'. The difference between interest earned and interest paid measures the earning spread. It needs to be noted that higher number of credit-accounts per employee does not necessarily mean higher disbursal of credit. Generally, the client base of the profit making banks is narrow and they deal with large borrowers.

This helps them to reduce the per account servicing cost. Many of the public sector banks, on the other hand, have to service a large number of credit accounts on account of their obligations under the priority sector lending programmes. Therefore, it is expected that the 'number of accounts dealt by the banks' and 'the amount of credit given' will be negatively related to each other. The correlation structure shows that 'accounts per employee' is negatively related with rest of the four indicators. Due care was, therefore, taken to drop such indicators which yield negative loadings on first principal component as this goes against the concept of normal economic efficiency from a theoretical point of view. Besides, in order to ensure intra-sectoral balances among these three sets of indicators, some indicators such as 'establishment expenses as percentage to working funds', 'cost of deposits', etc., in the category of financial management have been dropped. A list of indicators representing major criterion of efficiency *viz.* profitability, productivity and financial management are given below.

**A. Profitability:**

1. Net profit as percentage to total income (NPI)
2. Return on assets: Net profit/Total assets (ROA)
3. Return on equity: Net profit/(Capital + Reserves) (ROE)
4. Net profit as percentage to deposits (NPD)
5. Net profit as percentage to spread (NPS)

**B. Productivity:**

1. Advances per employee (APE)
2. Deposits per employee (DPE)
3. Income per employee (IPE)
4. Spread per employee (SPE)
5. Number of accounts per employee (ACPE)

**C. Financial Management:**

1. Yield on assets: Interest income/Total assets (YOA)
2. Yield on advances: Interest earned on advances/Total advances (YOAD)
3. Yield on investments: Income from investments/Investments (YOI)
4. Spread as percentage to establishment expenses (SPEST)
5. Spread as percentage to total assets (SPTA)

There are more than three hundred banks operating in India, out of which 92 are scheduled commercial banks (SCBs) (excluding 196 Regional Rural Banks). All banks could not be, however, included in the analysis due to lack of comparable published data. Some of the newly opened banks had also to be excluded from the analysis to make a homogenous group of banks. This study is based on 73 banks which account over 95 per cent of deposits and credits of all scheduled commercial banks in March 1995. Therefore, the study has a much more wider coverage than most of the earlier studies with twenty-seven public sector banks[3], twenty-three foreign banks and another twenty-three Indian private banks.

The data used in this study have been collected from the Balance Sheet of individual banks published in Indian Bank Association Bulletin, 1995-96 by Indian Banks' Association and Basic Statistical Return (BSR-1) by Reserve Bank of India. The reference year of the study relates to the financial year 1994-95.

## Section IV
## Empirical Analysis

The efficiency/performance of the banks has been analysed using principal component analysis. The analysis showed that the first

principal component for 'profitability indicators' explained about 87.0 per cent of the total variation in the data set (Table 1) which is considerably high in respect of socio-economic data. Similarly, the first component for 'productivity' and 'financial management' explained 85.1 per cent and 57.4 per cent of the data sets, respectively. Thus, the explanatory capacity of the first component is very much satisfactory in all the three performance criteria chosen in the study. Table 1 reports the data on factor loadings of the first and second principal components in each category of performance criteria.

**Table 1 : Principal Component Loadings**

| Profitability | | | Productivity | | | Financial Management | | |
|---|---|---|---|---|---|---|---|---|
| Indicators | Component Loadings | | Indicators | Component Loadings | | Indicators | Component Loadings | |
| | 1st | 2nd | | 1st | 2nd | | 1st | 2nd |
| NPI | 0.476 | -0.032 | APE | 0.464 | 0.141 | YOA | 0.521 | 0.339 |
| ROA | 0.466 | -0.204 | DPE | 0.457 | 0.220 | YOAD | 0.372 | 0.708 |
| ROE | 0.424 | 0.638 | IPE | 0.478 | 0.149 | YOI | 0.405 | -0.354 |
| NPD | 0.433 | -0.676 | SPE | 0.470 | 0.202 | SPEST | 0.387 | -0.451 |
| NPS | 0.435 | 0.305 | ACPE | -0.356 | 0.932 | SPTA | 0.526 | -0.233 |
| %age of variation explained | 87.03 | 6.92 | %age of variation explained | 85.14 | 10.57 | %age of variation explained | 57.43 | 21.18 |

## A. Comparison of Profitability

The composite index of efficiency applying the profitability criterion has been worked out based on the five indicators as detailed in Section III. The indices for all 73 banks based on the first principal component and second principal component are presented in Table 2. In the first principal component, all indicators yielded almost equal component loadings showing that their relationship with the derived variable (first component) are, more or less, of equal importance. All the loadings are positively related with the first component and varied from 0.424 to 0.476. The banks are arranged in descending order of magnitude of indices derived from the first component implying that the banks with the highest value of index are the most efficient. As may be seen from the table,

the index value varied from 4.069 to (-)7.100. Since the indicators have been standardised with respect to their means ($\bar{x}$), on the whole, it can be interpreted that the banks yielding positive index on the first component are above the 'average' level of performance in the industry. In other words, these banks could be treated as efficient banks. Thus, there were thirty-three such banks in respect of 'profitability' during 1994-95. Bank of Tokyo is on the top followed by Mashreq Bank and American Express Bank. Among the thirty-three banks with positive index value, there were nineteen foreign banks and twelve Indian private banks. The remaining two banks were Corporation Bank and Oriental Bank of Commerce. Among the first twenty best performing banks, the majority of them were foreign banks. Bank of Madura, Vysya Bank and Bank of Rajasthan held the fourth, ninth and tenth positions in the ranking hierarchy (Table 2). Most of the nationalised banks figured among the least performing category.

## B. Comparison of Productivity

Five indicators are chosen to evaluate productivity performance of banks. These mainly represent the indicators of labour productivity *viz.* 'advances per employee', 'deposits per employee', 'income per employee', 'spread per employee' and 'accounts per employee'. The 'number of credit accounts per employee' generated negative loading (-0.356) with the first principal component which is theoretically justified in the Indian context. The loadings for remaining four indicators were positive and varied from 0.457 to 0.478. The indices for productivity efficiency have been compiled and presented in Table 3. There were twenty banks which could be treated as relatively efficient according to 'productivity' criterion as they yielded positive indices on the first component. In the hierarchy list, Credit Lyonnais occupied the highest position followed by Societe Generale and Banque Indosuez. However, Credit Lyonnais occupied 13th position in respect of profitability[4]. Among the Indian banks, Bharat Overseas Bank and Vysya Bank occupied 24th and 25th positions. An important feature of the productivity performance of the Indian banks is that their value of indices varied within the close range of (-) 1.009 to (-) 1.822, indicating that not much

productivity differences could be observed among these banks. There was hardly any distinction between public sector banks and other Indian private banks. The analysis revealed that foreign banks did relatively well in terms of productivity efficiency as compared to Indian banks.

## C. Comparison of Financial Management

In this category, five indicators *viz.* 'yield on assets', 'yield on advances', 'yield on investments', 'spread as percentage to establishment expenses' and 'spread as percentage to total assets' have been considered. These indicators represent a fair measure of efficiency in terms of financial management. The indices developed for 'management efficiency' are presented in Table 4. The loading structure shows that all indicators contributed positively to the efficiency index based on the first component and the loading varied widely from 0.372 to 0.526 as compared to 0.424 to 0.476 in case of profitability. The relative performance among the banks indicate that a number of Indian banks were ahead of some of the foreign banks, although the latter category of banks as a group did well compared to their Indian counterparts. The value of indices varied within a wide range of (-)2.966 to 7.431. This shows the extent of differences in terms of financial management among the banks. There are 27 banks with positive indices and most of them are found to be foreign banks. In terms of rank, Banque Nationale de Paris was on the top, although its position was 12th in respect of profitability efficiency and 19th in respect of productivity efficiency (Table 6). Among the nationalised banks, State Banks group showed relatively better performance than others. Within this group, State Bank of Mysore was on the top (33rd) and State Bank of India was at the bottom (49th position).

## D. Overall Efficiency

The indices for overall efficiency have been worked out using PCA and taking into account all the 15 indicators of efficiency. The first principal component explained 56.27 per cent of total

variation. As in the case of individual efficiency criteria, the overall efficiency indices showed a wide variation of performance among the banks. The first twenty positions were occupied by foreign banks (Table 5). Out of top 25 banks, 22 banks belonged to foreign banks group and the remaining 3 banks belonged to Indian private bank group. Among the nationalised banks, Oriental Bank of Commerce showed a relatively better performance in terms of overall efficiency indices compared to others. Among the bottom fifteen banks, fourteen were public sector banks.

The relative position of an individual bank in the whole sample as well as within the four bank groups (State Banks, Nationalised Banks, Private Banks and Foreign Banks) are given in Table 7. The bank group-wise analysis showed that State Bank of Patiala topped the list in State Banks group followed by State Bank of Saurashtra. State Bank of Travancore was at the bottom in the overall efficiency measure. In case of nationalised banks group, Oriental Bank of Commerce topped overall efficiency indices followed by Corporation Bank, Bank of Baroda and Union Bank of India. Among the Indian private banks, Bank of Madura had the highest score whereas, Credit Lyonnais followed by Societe Generale and Mashreq Bank were the top performers among the foreign banks.

Besides, the overall efficiency indices were calculated based on area-specific indices also. The banks were ranked according to indices developed for three specific areas of efficiency as discussed in Section III. In this exercise, 'total ranks' have been considered as the indicator of efficiency (Table 6). The banks were further ranked on the basis of 'total ranks' and presented in Table 7. It was observed that some of the banks scored equal 'total ranks'. Therefore, their relative positions were determined using the conventional methodology for ranking. If the banks have equal 'total ranks', they were allotted equal positions[5].

From Table 5, it was observed that foreign banks occupied the first twenty-two positions and Oriental Bank of Commerce occupied 23rd position in overall efficiency. The next six positions were occupied by Indian private banks. Among the other public sector banks, State Bank of Patiala occupied 36th and Bank of Baroda held 39th position. In the group-wise analysis by ranking method, it was observed that the relative position of the individual bank within the groups did not differ much in the case of State Banks group, nationalised banks and foreign banks. However, wide variations were noticed in the case of private banks.

## E. Nature of Operations

In order to examine the inter-bank differences in the nature of operation, cluster analysis based on two-dimensional plotting of first two principal components was carried out for public sector banks, Indian private banks and foreign banks based on overall indices. The score values (indices) for both the components are presented in Table 5. Taking the first component along X-axis and the second component along Y-axis, two-dimensional plotting was constructed for each bank[6]. It is observed that among 27 Public Sector Banks only United Bank of India formed a separate cluster indicating that it has a different identity as far as its efficiency is concerned (Fig. 1). The rest of the banks formed another cluster. Among the Indian Private sector banks, Benares State Bank alone formed one cluster which had the lowest rank in terms of efficiency performance (Fig.2). The dispersion among this group of banks was wider than the public sector banks. This indicates that the nature of operations in public sector banks did not differ much from one another, while it varied across the private sector banks.

All the Foreign Banks except Standard Chartered Bank were above the average level of efficiency (Fig.3). Most of these banks showed different levels of operational efficiency. While Standard Chartered Bank, Sonali Bank, Barclays Bank, Societe Generale and Credit Lyonnais differed greatly in terms of their nature of operation from the rest, a few others showed more or less similar levels of operational efficiency.

## Section V
## Conclusions

With the progressive liberalisation of the financial sector, Indian banking is fast moving towards global standards. It has to now reckon with competition both from within and outside the depository institutions. The objective of the present study was to examine the inter-bank performance differences in efficiency in the post-reform period. The results of the study based on the balance sheets in 1994-95 showed that there is a wide variation in efficiency performance among banks with different ownership patterns. The performances of public sector banks were relatively poor compared to other category of banks. This might be attributed to their typical organisational culture, technological development, employment pattern and managerial skills, etc. The group-wise performance indicated that excepting a few, not much variation could be found in terms of overall efficiency indices of the public sector banks, whereas there was a wide variation in performance within the foreign banks.

The cluster analysis based on two-dimensional plotting also showed that the nature of operational efficiency among the public sector banks did not show significant variation. Among the Indian private banks, however, the nature of operation varied considerably and inter-bank differences were wider than the public sector banks.

It is too early, however, to derive any firm inference on the efficiency performance of banks based on the indicators of profitability, productivity and financial management for any one year. The focus of the study was on a static analysis of efficiency and the inter-bank comparisons within this framework. It is possible that though the public sector banks did relatively poor compared to others, their performance may have improved over the years given the fact that many of these banks have shown improved balance sheet behaviour in the recent years. Apart from internal factors, the performance of public sector banks are influenced by several external factors such as the policy conditions relating to the allocation of credit to certain priority sectors and their entrenchment into the

rural areas. Accounting for these conditions, the efficiency performance of public sector banks may not be very divergent from that of the other category of banks. Nevertheless, in so far as their relatively poor performance is due to internal factors within their controls, the prospect for improved efficiency will critically depend on how efficiently they reorient their activities so as to turn around their position *vis-a-vis* the most efficient operators in the banking industry.

## Notes

1. There are various methods for computing the factors such as minor solution, principal axes, maximum likelihood, etc. {see, Harman (1967)}.

2. In the similar way, Mitra *et al.* (1980) used factor scores as indicators in their study.

3. There are 8 banks belonging to State Bank of India & its associates group and 19 belonging to Nationalised Banks group.

4. This reveals that area-specific efficiency may vary widely for any particular bank and there is a need to judge efficiency from different points of view.

5. That is, if the rth, (r+1)th, .....(r+s)th banks scored equal total ranks, then each bank was allotted rth position and the next bank occupied (r+s+1)th position {Sarker (1995)}.

6. Similar methodology may be found in Sarker (1989 & 1995).

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FIG. 1: TWO–DIMENSIONAL PLOTTING – PUBLIC SECTOR BANKS

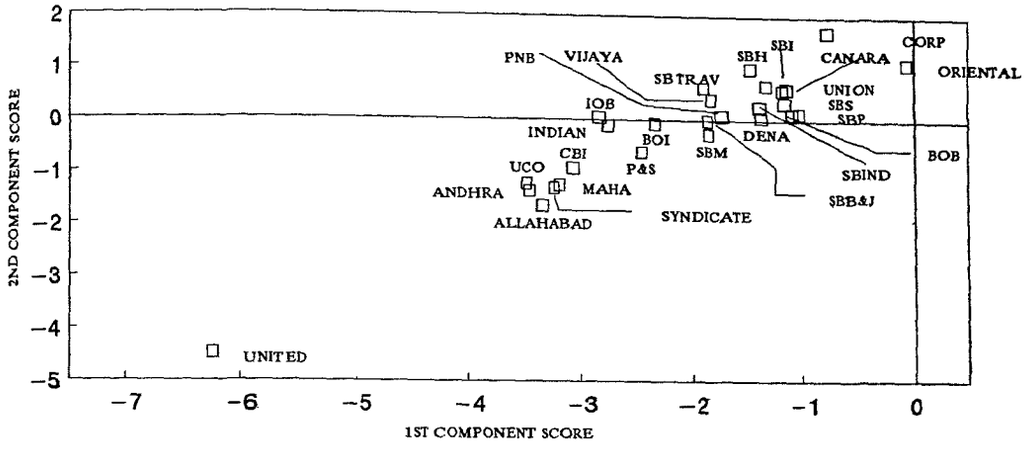


FIG. 2: TWO–DIMENSIONAL PLOTTING – INDIAN PRIVATE SECTOR BANKS

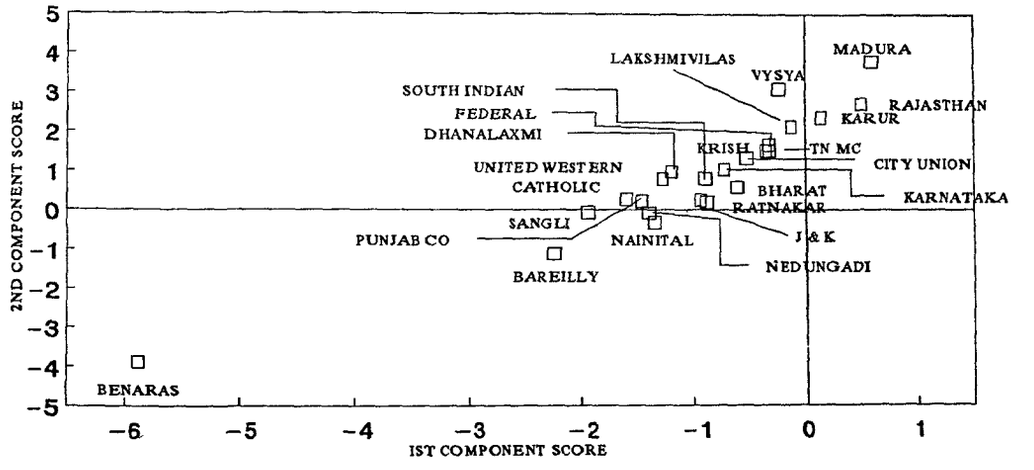


FIG. 3: TWO–DIMENSIONAL PLOTTING – FOREIGN BANKS

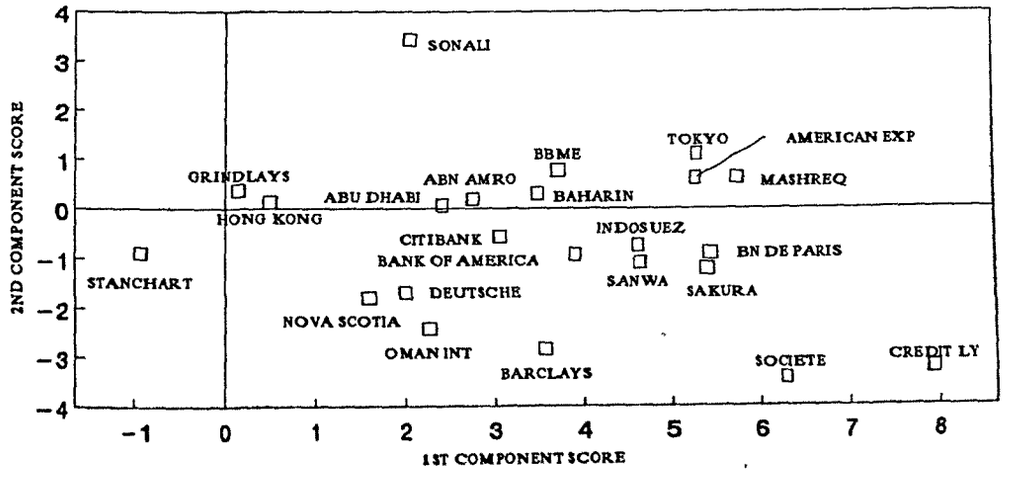

**TABLE 2: EFFICIENCY INDICES FOR BANKS ACCORDING TO PROFITABILITY CRITERION**

| BANK NAME | INDICES BASED ON | |
|---|---|---|
| | 1ST COMP. | 2ND COMP. |
| Bank of Tokyo | 4.069 | -0.974 |
| Masherq Bank | 3.958 | -0.392 |
| American Express Bank | 3.587 | -0.772 |
| Bank of Madura | 3.343 | 1.416 |
| Sonali Bank | 3.161 | 0.005 |
| British Bank of Middle East | 2.835 | -0.014 |
| Sakura Bank | 2.431 | -0.574 |
| Banque Indosuez | 2.414 | 0.483 |
| Vysya Bank | 2.413 | 1.213 |
| Bank of Rajasthan | 2.400 | 0.371 |
| Sanwa Bank | 2.320 | -2.479 |
| Banque Nationale de Paris | 2.205 | -2.012 |
| Credit Lyonnais | 2.141 | -0.220 |
| Bank of Bahrain and Kuwait | 2.030 | 0.021 |
| Karur Vysya Bank | 1.907 | 0.963 |
| ABN Amro Bank | 1.693 | -0.412 |
| Lakshmi Vilas Bank | 1.680 | 0.624 |
| Abu Dhabi Commercial Bank | 1.630 | 0.310 |
| Bank of America | 1.579 | -0.551 |
| Citibank N.A. | 1.329 | -0.324 |
| Tamil Mercantile Bank | 1.124 | 0.398 |
| Lord Krishna Bank | 1.116 | 0.137 |
| Federal Bank | 1.091 | 0.461 |
| Corporation Bank | 0.844 | 0.653 |
| Oriental Bank of Commerce | 0.797 | -0.227 |
| City Union Bank | 0.771 | 0.611 |
| Societe Generale | 0.665 | -0.422 |
| ANZ Grindlays Bank | 0.539 | -0.292 |
| Karnataka Bank | 0.321 | 0.776 |
| Barclays Bank | 0.317 | -1.118 |
| Honkong & Shanghai Banking Corporation | 0.274 | -0.179 |
| South Indian Bank | 0.206 | 0.409 |
| Dhanalakshmi Bank | 0.125 | 0.346 |
| Bhara Overseas Bank | -0.007 | 0.256 |
| United Western Bank | -0.123 | 0.529 |
| State Bank of Hyderabad | -0.151 | 0.436 |
| Canara Bank | -0.225 | -0.027 |

(Contd.)

**TABLE 2: EFFICIENCY INDICES FOR BANKS ACCORDING TO PROFITABILITY CRITERION**

| BANK NAME | INDICES BASED ON | |
|---|---|---|
| | 1ST COMP. | 2ND COMP. |
| Union Bank of India | -0.271 | 0.325 |
| Ratnakar Bank | -0.322 | 0.392 |
| State Bank of India | -0.341 | 0.149 |
| Deutsche Bank | -0.449 | -0.302 |
| Jammu & Kashmir Bank | -0.457 | 0.169 |
| Bank of Nova Scotia | -0.487 | -0.420 |
| Bank of Baroda | -0.564 | 0.054 |
| State Bank of Travancore | -0.568 | 0.617 |
| Punjab Co-operative Bank | -0.577 | -0.233 |
| State Bank of Saurashtra | -0.578 | 0.445 |
| State Bank of Patiala | -0.617 | 0.070 |
| Vijaya Bank | -0.699 | -0.004 |
| Catholic Syrian Bank | -0.708 | 0.409 |
| State Bank of Indore | -0.736 | 0.418 |
| Oman International Bank | -0.764 | -0.099 |
| Dena Bank | -0.824 | 0.008 |
| Nedungadi Bank | -0.902 | 0.353 |
| Punjab National Bank | -1.038 | 0.037 |
| Standard Chartered Bank | -1.076 | -0.181 |
| Nainital Bank | -1.102 | 0.119 |
| State Bank of Bikaner & Jaipur | -1.172 | 0.258 |
| Sangli Bank | -1.307 | 0.004 |
| Bank of India | -1.367 | -0.088 |
| State Bank of Mysore | -1.369 | 0.200 |
| Indian Bank | -1.509 | -0.068 |
| Indian Overseas Bank | -1.572 | -0.090 |
| Punjab & Sindh Bank | -1.944 | -0.098 |
| Bareilly Corporation Bank | -2.269 | -0.313 |
| Central Bank of India | -2.555 | -0.110 |
| Bank of Maharashtra | -2.897 | -0.013 |
| UCO Bank | -3.004 | -0.009 |
| Syndicate Bank | -3.005 | -0.066 |
| Andhra Bank | -3.108 | -0.149 |
| Allahabad Bank | -3.217 | -0.203 |
| Benares State Bank | -6.336 | -0.325 |
| United Bank of India | -7.100 | -0.679 |

(Concld.)

**TABLE 3: EFFICIENCY INDICES FOR BANKS ACCORDING TO PRODUCTIVITY CRITERION**

| BANK NAME | INDICES BASED ON | |
|---|---|---|
| | 1ST COMP. | 2ND COMP. |
| Credit Lyonnais | 7.142 | 1.361 |
| Societe Generale | 5.816 | 0.879 |
| Banque Indosuez | 5.145 | 0.657 |
| Sakura Bank | 4.328 | 0.332 |
| Sanwa Bank | 3.901 | 0.060 |
| American Express Bank | 3.634 | 0.053 |
| Mashreq Bank | 3.528 | -0.066 |
| Bank of America | 3.392 | 0.137 |
| Barclays Bank | 2.737 | -0.490 |
| Deutsche Bank | 2.620 | -0.445 |
| British Bank of Middle East | 2.325 | -0.414 |
| Oman International Bank | 2.198 | -0.494 |
| Bank of Tokyo | 2.188 | -0.296 |
| Abu Dhabi Commercial Bank | 2.163 | -0.483 |
| Bank of Nova Scotia | 2.137 | -0.661 |
| ABN Amro Bank | 1.982 | -0.644 |
| Citibank N.A. | 1.944 | 1.924 |
| Bank of Bahrain and Kuwait | 1.617 | -0.782 |
| Banque Natiionale de Paris | 1.083 | -0.953 |
| Hongkong & Shanghai Banking Corporation | 0.111 | -0.705 |
| ANZ Grindlays Bank | -0.181 | -0.762 |
| Standard Chartered Bank | -0.188 | -1.342 |
| Sonali Bank | -0.430 | -1.410 |
| Bharat Overseas Bank | -0.550 | -1.129 |
| Vysya Bank | -0.649 | -0.383 |
| Oriental Bank of Commerce | -0.843 | -0.429 |
| Karur Vysya Bank | -0.852 | -0.409 |
| Bareilly Corporation Bank | -0.881 | -1.108 |
| State Bank of Patiala | -0.886 | -0.693 |
| Nainital Bank | -0.940 | -0.885 |
| Lakshmi Vilas Bank | -0.942 | -0.295 |
| Punjab Co-op. Bank | -0.949 | -0.865 |
| United Western Bank | -0.950 | -0.495 |
| State Bank of Saurashtra | -0.975 | -0.548 |
| Punjab & Sindh Bank | -0.988 | -0.480 |
| Bank of Baroda | -0.988 | 0.012 |
| Bank of Rajasthan | -0.997 | -0.260 |

(Contd.)

**TABLE 3: EFFICIENCY INDICES FOR BANKS ACCORDING TO PRODUCTIVITY CRITERION**

| BANK NAME | INDICES BASED ON | |
|---|---|---|
| | 1ST COMP. | 2ND COMP. |
| Dena Bank | -1.009 | -0.468 |
| Sangli Bank | -1.026 | -0.564 |
| Corporation Bank | -1.028 | 0.055 |
| Ratnakar Bank | -1.036 | -0.487 |
| City Union Bank | -1.089 | -0.141 |
| Union Bank of India | -1.101 | -0.033 |
| Bank of India | -1.109 | -0.067 |
| Tamilnadu Mercantile Bank | -1.110 | 0.371 |
| Karnataka Bank | -1.112 | -0.075 |
| Bank of Madura | -1.127 | 0.146 |
| Jammu & Kashmir Bank | -1.129 | 0.143 |
| Punjab National Bank | -1.134 | -0.218 |
| State Bank of Bikaner & Jaipur | -1.147 | -0.292 |
| Vijaya Bank | -1.166 | -0.043 |
| Canara Bank | -1.193 | 0.160 |
| Benares State Bank | -1.196 | -0.210 |
| State Bank of Indore | -1.213 | 0.079 |
| State Bank of India | -1.255 | 0.289 |
| Bank of Maharashtra | -1.278 | 0.082 |
| UCO Bank | -1.297 | 0.099 |
| Central Bank of India | -1.310 | 0.204 |
| Nedungadi Bank | -1.362 | 0.198 |
| State Bank of Mysore | -1.390 | 0.433 |
| Syndicate Bank | -1.397 | 0.372 |
| United Bank of India | -1.398 | 0.357 |
| Allahabad Bank | -1.404 | 0.569 |
| Federal Bank | -1.414 | 0.955 |
| Indian Overseas Bank | -1.436 | 0.725 |
| South Indian Bank | -1.442 | 0.748 |
| Indian Bank | -1.499 | 1.024 |
| Catholic Syrian Bank | -1.508 | 0.807 |
| Lord Krishna Bank | -1.511 | 1.164 |
| Andhra Bank | -1.671 | 1.145 |
| Dhanalakshmi Bank | -1.731 | 1.581 |
| State Bank of Travancore | -1.750 | 1.576 |
| State Bank of Hyderabad | -1.822 | 1.824 |

(Concld.)

**TABLE 4: EFFICIENCY INDICES FOR BANKS ACCORDING TO FINANCIAL MANAGEMENT CRITERION**

| BANK NAME | INDICES BASED ON | |
|---|---|---|
| | 1ST COMP. | 2ND COMP. |
| Banque Nationale de Paris | 7.431 | 1.294 |
| Credit Lyonnais | 4.205 | -0.323 |
| Barclays Bank | 4.103 | 4.203 |
| Societe Generale | 3.735 | -3.208 |
| Bank of Tokyo | 2.873 | 0.614 |
| Oman Intenational bank | 2.386 | -0.809 |
| Citibank N.A. | 2.119 | -0.063 |
| Bank of Bahrain and Kuwait | 2.089 | -1.674 |
| Mashreq Bank | 1.892 | -1.028 |
| Sakura Bank | 1.809 | -0.849 |
| Bank of America | 1.593 | -0.021 |
| American Express Bank | 1.484 | -0.933 |
| Bank of Nova Scotia | 1.213 | -0.129 |
| Deutsche Bank | 1.024 | -1.670 |
| ABN Amro Bank | 0.928 | -1.130 |
| British Bank of Middle East | 0.923 | -0.917 |
| Sanwa Bank | 0.563 | -1.869 |
| Hongkong & Shanghai Banking Corporation | 0.536 | -0.156 |
| Jammu & Kashmir Bank | 0.342 | 0.702 |
| Nedungadi Bank | 0.333 | 1.144 |
| Sonali Bank | 0.311 | -3.746 |
| Lord Krishna Bank | 0.155 | 0.854 |
| South Indian Bank | 0.141 | 1.147 |
| ANZ Grindlays Bank | 0.111 | 1.094 |
| Ratnakar Bank | 0.103 | 1.293 |
| Federal Bank | 0.070 | 0.856 |
| Abu Dhabi Commercial Bank | 0.044 | 0.170 |
| Standard Chartered Bank | -0.014 | 1.705 |
| Nainital Bank | -0.031 | 0.833 |
| Oriental Bank of Commerce | -0.039 | -0.115 |
| Banque Indosuez | -0.114 | 0.018 |
| Dhanalakshmi Bank | -0.122 | 0.604 |
| State Bank of Mysore | -0.177 | 0.442 |
| Bank of Baroda | -0.204 | 0.410 |
| Catholic Syrian Bank | -0.206 | 0.689 |
| STtate Bank of Patiala | -0.207 | 0.063 |
| Karnataka Bank | -0.227 | 0.470 |

(Contd.)

**TABLE 4: EFFICIENCY INDICES FOR BANKS ACCORDING TO FINANCIAL MANAGEMENT CRITERION**

| BANK NAME | INDICES BASED ON | |
|---|---|---|
| | 1ST COMP. | 2ND COMP. |
| State Bank of Indore | -0.276 | 0.165 |
| State Bank of Saurashtra | -0.336 | -0.094 |
| State Bank of Hyderabad | -0.370 | -0.291 |
| City Union Bank | -0.415 | 0.699 |
| Dena Bank | -0.473 | 0.201 |
| Tamil Nadu Mercantile Bank | -0.545 | 0.026 |
| Union Bank of India | -0.546 | -0.131 |
| Bharat Overseas Bank | -0.558 | -0.113 |
| Canara Bank | -0.588 | 0.298 |
| Bank of Rajasthan | -0.591 | -0.428 |
| State Bank of Travancore | -0.689 | 0.340 |
| State Bank of India | -0.707 | -0.384 |
| Bareilly Corporation Bank | -0.710 | 0.353 |
| Karur Vysya Bank | -0.774 | -0.250 |
| Punjab National Bank | -0.843 | -0.399 |
| State Bank of Bikaner & Jaipur | -0.850 | -0.007 |
| Lakshmi Vilas Bank | -0.962 | 0.271 |
| Punjab Co-op. Bank | -1.007 | 0.677 |
| Allahabad Bank | -1.066 | 0.461 |
| Aadhra Bank | -1.118 | 0.189 |
| Sangli Bank | -1.149 | -0.419 |
| United Western Bank | -1.176 | 0.278 |
| Syndicate Bank | -1.201 | 0.016 |
| Bank of Madura | -1.206 | -0.422 |
| Corporation Bank | -1.323 | -0.543 |
| Bank of Maharashtra | -1.391 | 0.158 |
| Vijaya Bank | -1.412 | 0.037 |
| Punjab & Sindh Bank | -1.468 | -0.196 |
| Central Bank of India | -1.580 | -0.157 |
| Bank of India | -1.778 | -0.022 |
| Indian Bank | -1.852 | 0.239 |
| UCO Bank | -1.888 | 0.035 |
| Indian Overseas Bank | -2.192 | -0.744 |
| Vysya Bank | -2.565 | -0.761 |
| United Bank of India | -2.603 | 0.126 |
| Benares State Bank | -2.966 | 0.826 |

(Concld.)

**TABLE 5: OVERALL EFFICIENCY INDICES BASED ON ALL INDICATORS**

| BANK NAME | INDICES BASED ON | |
|---|---|---|
| | 1ST COMP. | 2ND COMP. |
| Credit Lyonnais | 7.925 | -3.222 |
| Societie Generale | 6.276 | -3.431 |
| Mashreq Bank | 5.714 | 0.621 |
| Banque Nationale de Paris | 5.410 | -0.899 |
| Sakura Bank | 5.382 | -1.217 |
| Bank of Tokyo | 5.265 | 1.106 |
| American Express Bank | 5.249 | 0.614 |
| Sanwa Bank | 4.628 | -1.097 |
| Banque Indosuez | 4.607 | -0.742 |
| Bank of America | 3.895 | -0.935 |
| British Bank of Middle East | 3.700 | 0.771 |
| Barclays Bank | 3.565 | -2.845 |
| Bank of Bahrain and Kuwait | 3.472 | 0.305 |
| Citibank N.A. | 3.049 | -0.565 |
| ABN Amro Bank | 2.745 | 0.196 |
| Abu Dhabi Commercial Bank | 2.409 | 0.071 |
| Oman International Bank | 2.263 | -2.425 |
| Sonali Bank | 2.045 | 3.430 |
| Deutsche Bank | 1.999 | -1.698 |
| Bamk of Nova Scotia | 1.593 | -1.796 |
| Bank of Madura | 0.590 | 3.791 |
| Hongkong & Shanghai Banking Corporation | 0.500 | 0.128 |
| Bank of Rajasthan | 0.497 | 2.700 |
| ANZ Grindlays Bank | 0.155 | 0.372 |
| Karur Vysya Bank | 0.135 | 2.356 |
| Oriental Bank of Commerce | -0.067 | 1.106 |
| Lakshmi Vilas Bank | -0.135 | 2.126 |
| Vysya Bank | -0.246 | 3.092 |
| Lord Krishna Bank | -0.323 | 1.516 |
| Tamilnad Mercantile Bank | -0.330 | 1.660 |
| Federal Bank | -0.355 | 1.519 |
| Citi Union Bank | -0.537 | 1.314 |
| Bharat Overseas Bank | -0.614 | 0.574 |
| Karnataka Bank | -0.737 | 1.026 |
| Corporation Bank | -0.787 | 1.715 |
| Jammu & Kashmir Bank | -0.882 | 0.191 |
| South Indian Bank | -0.897 | 0.799 |

(Contd.)

**TABLE 5: OVERALL EFFICIENCY INDICES BASED ON ALL INDICATORS**

| BANK NAME | INDICES BASED ON | |
|---|---|---|
| | 1ST COMP. | 2ND COMP. |
| Standard Chartered Bank | -0.926 | -0.894 |
| Ratnakar Bank | -0.935 | 0.248 |
| State Bank of Patiala | -1.041 | 0.140 |
| Bank of Baroda | -1.106 | 0.133 |
| Union Bank of India | -1.151 | 0.618 |
| State Bank of Saurashtra | -1.168 | 0.342 |
| Canara Bank | -1.190 | 0.582 |
| Dhanalakshmi Bank | -1.195 | 0.972 |
| United Western Bank | -1.282 | 0.779 |
| State Bank of India | -1.343 | 0.675 |
| Nainital Bank | -1.350 | -0.324 |
| Dena Bank | -1.390 | 0.060 |
| State Bank of Indore | -1.397 | 0.261 |
| Nedungadi Bank | -1.400 | -0.084 |
| Punjab Co-op. Bank | -1.460 | 0.214 |
| State Bank of Hyderabad | -1.480 | 1.001 |
| Catholic Syrian Bank | -1.604 | 0.260 |
| Punjab National Bank | -1.737 | 0.091 |
| Vijaya Bank | -1.832 | 0.408 |
| State Bank of Mysore | -1.853 | -0.274 |
| State Bank of Bikaner & Jaipur | -1.866 | -0.006 |
| State Bank of Travancore | -1.901 | 0.623 |
| Sangli Bank | -1.944 | -0.080 |
| Bareilly Corporation Bank | -2.245 | -1.121 |
| Bank of India | -2.337 | -0.071 |
| Punjab & Sindh Bank | -2.463 | -0.618 |
| Indian Bank | -2.763 | -0.107 |
| Indian Overseas Bank | -2.841 | 0.049 |
| Central Bank of India | -3.078 | -0.927 |
| Bank of Maharashtra | -3.194 | -1.258 |
| Syndicate Bank | -3.244 | -1.312 |
| Allahabad Bank | -3.354 | -1.658 |
| Andhra Bank | -3.463 | -1.373 |
| UCO Bank | -3.493 | -1.233 |
| Benares State Bank | -5.877 | -3.876 |
| United Bank of India | -6.246 | -4.474 |

(Concld.)

**TABLE 6: RANKS ACCORDING TO EFFICIENCY INDICES BASED ON PROFITABILITY, PRODUCTIVITY AND MANAGEMENT CRITERIA**

| Name of the Bank | Profitability | Productivity | Financial Management | Total Ranks |
|---|---|---|---|---|
| **State Bank Group** | | | | |
| State Bank of Bikaner & Jaipur | 58 | 50 | 53 | 161 |
| State Bank of Hyderabad | 36 | 73 | 40 | 149 |
| State Bank of India | 40 | 55 | 49 | 144 |
| State Bank of Indore | 51 | 54 | 38 | 143 |
| State Bank of Mysore | 61 | 60 | 33 | 154 |
| State Bank of Patiala | 48 | 29 | 36 | 113 |
| State Bank of Saurashtra | 47 | 34 | 39 | 120 |
| State Bank of Travancore | 45 | 72 | 48 | 165 |
| **Nationalised Banks Group** | | | | |
| Allahabad Bank | 71 | 63 | 56 | 190 |
| Andhra Bank | 70 | 70 | 57 | 197 |
| Bank of Baroda | 44 | 36 | 34 | 114 |
| Bank of India | 60 | 44 | 67 | 171 |
| Bank of Maharashtra | 67 | 56 | 63 | 186 |
| Canara Bank | 37 | 52 | 46 | 135 |
| Central Bank of India | 66 | 58 | 66 | 190 |
| Corporation Bank | 24 | 44 | 62 | 130 |
| Dena Bank | 53 | 38 | 42 | 133 |
| Indian Bank | 62 | 67 | 68 | 197 |
| Indian Overseas Bank | 63 | 65 | 70 | 198 |
| Oriental Bank of Commerce | 25 | 26 | 30 | 81 |
| Punjab & Sindh Bank | 64 | 35 | 65 | 164 |
| Punjab National Bank | 55 | 49 | 52 | 156 |
| Syndicate Bank | 69 | 61 | 60 | 190 |
| UCO Bank | 68 | 57 | 69 | 194 |
| Union Bank of India | 38 | 43 | 44 | 125 |
| United Bank of India | 73 | 62 | 72 | 207 |
| Vijaya Bank | 49 | 51 | 64 | 164 |
| **Private Banks Group** | | | | |
| Bank of Madura | 4 | 47 | 61 | 112 |
| Bank of Rajasthan | 10 | 37 | 47 | 94 |
| Bareilly Corporation Bank | 65 | 28 | 50 | 143 |
| Benares State Bank | 72 | 53 | 73 | 198 |
| Bharat Overseas Bank | 34 | 24 | 45 | 103 |

(Contd.)

**TABLE 6: RANKS ACCORDING TO EFFICIENCY INDICES BASED ON PROFITABILITY, PRODUCTIVITY AND MANAGEMENT CRITERIA**

| Name of the Bank | Profitability | Productivity | Financial Management | Total Ranks |
|---|---|---|---|---|
| Catholic Syrian Bank | 50 | 68 | 35 | 153 |
| City Union Bank | 26 | 42 | 41 | 109 |
| Dhanalakshmi Bank | 33 | 71 | 32 | 136 |
| Federal Bank | 23 | 64 | 26 | 113 |
| Jammu & Kashmir Bank | 42 | 48 | 19 | 109 |
| Karnataka Bank | 29 | 46 | 37 | 112 |
| Karur Vysya Bank | 15 | 27 | 51 | 93 |
| Lakshmi Vilas Bank | 17 | 31 | 54 | 102 |
| Lord Krishna Bank | 22 | 69 | 22 | 113 |
| Nainital Bank | 57 | 30 | 29 | 116 |
| Nedungadi Bank | 54 | 59 | 20 | 133 |
| Punjab Co-op. Bank | 46 | 32 | 55 | 133 |
| Ratnakar Bank | 39 | 41 | 25 | 105 |
| Sangli Bank | 59 | 39 | 58 | 156 |
| South Indian Bank | 32 | 66 | 23 | 121 |
| Tamilnad Mercantile Bank | 21 | 45 | 43 | 109 |
| United Western Bank | 35 | 33 | 59 | 127 |
| Vysya Bank | 9 | 25 | 71 | 105 |
| **Foreign Banks Group** | | | | |
| ABN Amro Bank | 16 | 16 | 15 | 47 |
| Abu Dhabi Commercial Bank | 18 | 14 | 27 | 59 |
| American Express Bank | 3 | 6 | 12 | 21 |
| ANZ Grindlays Bank | 28 | 21 | 24 | 73 |
| Bank of America | 19 | 8 | 11 | 38 |
| Bank of Bahrain and Kuwait | 14 | 18 | 8 | 40 |
| Bank of Nova & Scotia | 43 | 15 | 13 | 71 |
| Bank of Tokyo | 1 | 13 | 5 | 19 |
| Banque Indosuez | 8 | 3 | 31 | 42 |
| Banque Nationale de Paris | 12 | 19 | 1 | 32 |
| Barclays Bank | 30 | 9 | 3 | 42 |
| British Bank of Middle East | 6 | 11 | 16 | 33 |
| Citibank N.A. | 20 | 17 | 7 | 44 |
| Credit Lyonnais | 13 | 1 | 2 | 16 |
| Deutsche Bank | 41 | 10 | 14 | 65 |
| Hongkong & Shanghai Banking Corporation | 31 | 20 | 118 | 69 |
| Mashreq Bank | 2 | 7 | 9 | 18 |
| Oman International Bank | 52 | 12 | 6 | 70 |
| Sakura Bank | 7 | 4 | 10 | 21 |
| Sanwa Bank | 11 | 5 | 17 | 33 |
| Societie Generale | 27 | 2 | 4 | 33 |
| Sonali Bank | 5 | 23 | 21 | 49 |
| Standard Chartered Bank | 56 | 22 | 28 | 106 |

(Concld.)

TABLE 7: OVERALL AND WITHIN GROUP POSITIONS OF ALL BANKS

| Name of the Bank | Overall | | Within Group | |
|---|---|---|---|---|
| | Adding Ranks | Taking all Indicators | Adding Ranks | Taking all Indicators |
| **State Banks Group** | | | | |
| State Bank of Patiala | 36 | 40 | 1 | 1 |
| State Bank of Saurashtra | 41 | 43 | 2 | 2 |
| State Bank of Indore | 51 | 50 | 3 | 4 |
| State Bank of India | 53 | 47 | 4 | 3 |
| State Bank of Hyderabad | 54 | 53 | 5 | 5 |
| State Bank of Mysore | 56 | 57 | 6 | 6 |
| State Bank of Bikaner & Jaipur | 59 | 58 | 7 | 7 |
| State Bank of Travancore | 62 | 59 | 8 | 8 |
| **Nationalised Banks Group** | | | | |
| Oriental Bank of Commerce | 23 | 26 | 1 | 1 |
| Corporation Bank | 45 | 35 | 4 | 2 |
| Bank of Baroda | 39 | 41 | 2 | 3 |
| Union Bank of India | 43 | 42 | 3 | 4 |
| Canara Bank | 49 | 44 | 6 | 5 |
| Dena Bank | 46 | 49 | 5 | 6 |
| Punjab National Bank | 57 | 55 | 7 | 7 |
| Vijaya Bank | 60 | 56 | 8 | 8 |
| Bank of India | 63 | 62 | 10 | 9 |
| Punjab & Sindh Bank | 60 | 63 | 8 | 10 |
| Indian Bank | 69 | 64 | 16 | 11 |
| Indian Overseas Bank | 71 | 65 | 18 | 12 |
| Central Bank of India | 65 | 66 | 12 | 13 |
| Babk of Maharashtra | 64 | 67 | 11 | 14 |
| Syndicate Bank | 65 | 68 | 12 | 15 |
| Allahabad Bank | 65 | 69 | 12 | 16 |
| Andhra Bank | 69 | 70 | 16 | 17 |
| UCO Bank | 68 | 71 | 15 | 18 |
| United Bank of India | 73 | 73 | 19 | 19 |
| **Private Banks Group** | | | | |
| Bank of Madura | 34 | 21 | 10 | 1 |
| Bank of Rajasthan | 25 | 23 | 2 | 2 |
| Karur Vysya Bank | 24 | 25 | 1 | 3 |
| Lakshmi Vilas Bank | 26 | 27 | 3 | 4 |
| Vysya Bank | 28 | 28 | 5 | 5 |
| Lord Krishna Bank | 36 | 29 | 12 | 6 |
| Tamilnad Mercantile Bank | 31 | 30 | 7 | 7 |
| Federal Bank | 36 | 31 | 12 | 8 |

(Contd.)

TABLE 7: OVERALL AND WITHIN GROUP POSITIONS OF ALL BANKS

| Name of the Bank | Overall | | Within Group | |
|---|---|---|---|---|
| | Adding Ranks | Taking all Indicators | Adding Ranks | Taking all Indicators |
| City Union Bank | 31 | 32 | 7 | 9 |
| Bharat Overseas Bank | 27 | 33 | 4 | 10 |
| Karnataka Bank | 34 | 34 | 10 | 11 |
| Jammu & Kashmir Bank | 31 | 36 | 7 | 12 |
| South Indian Bank | 42 | 37 | 15 | 13 |
| Ratnakar Bank | 28 | 39 | 5 | 14 |
| Dhanalakshmi Bank | 50 | 45 | 19 | 15 |
| United Western Bank | 44 | 46 | 16 | 16 |
| Nainital Bank | 40 | 48 | 14 | 17 |
| Nedungadi Bank | 46 | 51 | 17 | 18 |
| Punjab Co-op. Bank | 46 | 52 | 17 | 19 |
| Catholic Syrian Bank | 55 | 54 | 21 | 20 |
| Sangli Bank | 57 | 60 | 22 | 21 |
| Bareilly Corporation Bank | 51 | 61 | 20 | 22 |
| Benares State Bank | 71 | 72 | 23 | 23 |
| **Foreign Banks Group** | | | | |
| Credit Lyonnais | 1 | 1 | 1 | 1 |
| Societie Generale | 7 | 2 | 7 | 2 |
| Mashreq Bank | 2 | 3 | 2 | 3 |
| Banque Nationale de Paris | 6 | 4 | 6 | 4 |
| Sakura Bank | 4 | 5 | 4 | 5 |
| Bank of Tokyo | 3 | 6 | 3 | 6 |
| American Express Bank | 4 | 7 | 4 | 7 |
| Sanwa Bank | 7 | 8 | 7 | 8 |
| Banque Indosuez | 12 | 9 | 12 | 9 |
| Bank of America | 10 | 10 | 10 | 10 |
| British Bank of Middle East | 7 | 11 | 7 | 11 |
| Barclays Bank | 12 | 12 | 12 | 12 |
| Bank of Bahrain & Kuwait | 11 | 13 | 11 | 13 |
| Citibank N.A. | 14 | 14 | 14 | 14 |
| ABN Amro Bank | 15 | 15 | 15 | 15 |
| Abu Dhabi Commercial Bank | 17 | 16 | 17 | 16 |
| Oman International Bank | 20 | 17 | 20 | 17 |
| Sonali Bank | 16 | 18 | 16 | 18 |
| Deutsche Bank | 18 | 19 | 18 | 19 |
| Bank of Nova Scotia | 21 | 20 | 21 | 20 |
| Hongkong & Shanghai Banking Corporation | 19 | 22 | 19 | 21 |
| ANZ Grindlays Bank | 22 | 24 | 22 | 22 |
| Sstandard Chartered Bank | 30 | 38 | 23 | 23 |

(Concld.)

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# BOOK REVIEW

***Foundations of International Macroeconomics*, By Maurice Obstfeld and Kenneth Rogoff, The MIT Press, 1996, pp. 804, $75.**

Cross-border international capital flows were estimated at $1700 billion in 1996. Notwithstanding the Feldstein-Horioka puzzle, the integration of world financial markets has been adequately demonstrated by the contagion sparked off by the financial crisis in Thailand. The crisis in Thailand quickly spread to other parts, affecting almost all the important financial markets in the world. It is obvious that studying macroeconomics in traditional mode is fast losing its relevance in this milieu. Much of the macroeconomics was based on the domestic policy issues revolving around IS-LM synthesis. The Copernician revolution in macroeconomics may not be over yet, but plenty of insightful new literature has come up which has taken macroeconomics considerably ahead of the discredited fixed price IS-LM framework. Most of this literature is still unavailable to economists who are not regular readers of journals, and there was a crying need for a meaningful text to understand this literature. Obstfeld and Rogoff's text has broken new grounds to fill in this vacuum.

The authors state their motivation for writing the book, as a lack of consensus on the subject matter of *open economy macroeconomics*, which they believe, is another name for *international finance*. One is not so sure whether open economy macroeconomics is the same thing as international finance. After perusal of the graduate courses or other text-books on these subjects one is left with a feeling that both open economy macroeconomics and international finance cover overlapping issues in macroeconomics and finance with an open economy perspective. Yet the former approaches the subject matter with tools blooded in

macroeconomics, while the latter prefers relatively more of a hard-core dependence on a financial calculator. International macroeconomics or the open economy macroeconomics does give economics students a radically new way of looking at macroeconomics, growth theory as well as international finance by integrating these fields.

A typical international finance course covers introduction to exchange rate determination, the interest parities, forward premia, swaps and possible triangular strategies, Mundell-Fleming model and international monetary institutions. There are universities, which teach international monetary economics courses as distinct from international finance. It is not clear whether many benefits accrue by making fine distinctions between international finance, international money, international macroeconomics and open economy macroeconomics. Perhaps increasing reductionism is not a very good idea. What is of greater relevance is that Obstfeld and Rogoff have provided a differentiated product, which has increased our understanding of the macroeconomic issues arising from increased international financial flows. It is a "must" text for any graduate course in either of the disciplines discussed above, even though these related disciplines have distinctive focus.

The integration of the related disciplines is best reflected in the first seven chapters of the book, which provide a neat synthesis of real economy with international finance and macroeconomic issues, with the help of the endogenous growth theory. In this context, Chapter 7 in particular raises important policy issues. Taking recourse to stochastic and continuous time growth models, it surveys the East Asian growth experience discussing Allen Young's growth accounting which forewarned about the difficulties in sustaining high growth in East Asia. It also explains the Baumol-De Long-Romer debate on productivity convergence. The integration of growth dynamics with the help of this chapter would truly revolutionize our understanding of macroeconomics.

Other absorbing issues covered in the first seven chapters include the discussion on productivity differences in tradable and non-

tradable goods sector which lead to the possibility of Harrod-Balassa-Samuelson effect on calculations of the equilibrium real exchange rate. These discussions in Chapter 4 are of particular relevance for many East Asian economies, particularly Hong Kong. The recent currency crashes in these countries, as also the downward correction of the rupee in response to these developments need to be carefully interpreted after empirically accounting for the Harrod-Balassa-Samuelson effect. The international portfolio diversification and the Home Bias puzzle, as also the moral hazard in international lending are meaningful adjuncts to this literature and are concisely discussed in the subsequent chapters.

It is interesting to make a comparative evaluation of the texts available on a particular theme while reviewing any book. Such an exercise is rendered extremely difficult in this case. Obstfeld and Rogoff's book is not only the first of its kind, but till date remains unique in its coverage, if not approach, to the subject matter. One could consider picking a hand few of texts available in related subjects, such as Dornbusch's open economy macro-economics, Visser and Smits' book on International Monetary Economics, Garbe's book on International Finance, or Burstein's book on Open Economy Monetary Economics. There is little to bind the contents in any of these books with that in Obstfeld and Rogoff. For instance, Visser and Smits' Guide to International Monetary Economics was published, just a year before Obstfeld and Rogoff. The text focuses on exchange rate systems and exchange rate theories by discussing the IS-LM models for open economy, monetary and portfolio models of exchange rate behaviour and issues of exchange rate pegs, policy coordination and monetary unions. Even though Visser and Smits talk at length about fixed exchange rates and monetary union, the text makes no reference to the multiple equilibria in financial markets, which can lead to speculative attacks not necessarily related to fundamentals. It misses out on the state of the art in the literature. Interestingly, the book contains 229 references in bibliography, but only 19 of them are in common with the 625 odd references in Obstfeld and Rogoff. This is a very poor scorecard for commonality. If the motivation of Obstfeld and Rogoff in writing the book was Professor Alan Deardorff's finding

that there was little commonality between the reading lists in international finance for the top eight graduate schools, one sincerely hopes that their book would further this objective.

In terms of the coverage of the subject matter, the closest any textual matter comes to Obstfeld and Rogoff is the Handbook of International Economics (Volume III) edited by Gene Grossman and Kenneth Rogoff. The Handbook brought out in 1995, surveys exchange rate literature, which forms a large part of the core of Obstfeld and Rogoff's book. Yet handbooks, almost by definition are surveys and not texts. Handbooks can tell what constitutes the state of the art and how best this literature can be interpreted. But Handbooks are woefully inadequate in understanding the mechanics of the proofs and seldom provide a binding systematic treatment. Obstfeld and Rogoff's book is outstanding in that it is well crafted and deals clearly, thoroughly and homogeneously the wide-spectrum of seemingly difficult literature which has emerged in the field of international macroeconomics.

Perhaps, it would be more instructive to compare the Obstfeld-Rogoff text to that of Blanchard and Fischer. While there is little in common in terms of the coverage, Blanchard and Fischer's macroeconomics text perhaps comes closest in its approach to that of Obstfeld and Rogoff. Blanchard and Fischer perhaps provided the first macroeconomics text, which relied on micro-foundations and brought to reader, the modern macroeconomics. The text introduced analytical framework essential for understanding the ongoing research at the frontier of the subject. At the heart of the Blanchard and Fischer's text are the overlapping generations (OLG) framework introduced to the reader through the Ramsey problem. This framework is essential to an understanding of the determination of saving and capital accumulation or the role-played by monetary and fiscal policies in affecting the real behaviour in the economy. The book weaves its threads around this OLG framework. The framework helped in tracking the seemingly intractable questions confronting macroeconomists. For example, why and when money is used instead of credit. Money buys goods, goods buy money but goods do not buy goods. The book translated much of

the work in contemporary journals by introducing the Clower constraint and developing the cash-in-advance models. Solving the models for equilibrium prices yields intuitively interesting results for policies, including possible effects of open market operations. The models are then extended to provide an understanding of multiple equilibria, bubbles and non-linearities in asset prices. The OLG framework also helps in learning about the smoothing behaviour of economic agents which affects the optimal consumption, investment and inventory behaviour. This provides a link to understanding macro-economic fluctuations, including those arising from productivity shocks. Much of the recent business cycle literature remained obscure to students till Blanchard and Fischer provided a basic framework to understand this.

Obstfeld and Rogoff's book in no way attempts to reproduce what Blanchard and Fischer have already provided. Instead they produce a complementary product to understanding present day macroeconomic problems. They concentrate exclusively on open economy framework and cover an entirely new literature outside the discipline covered by Blanchard and Fischer. Yet they adopt an approach similar to that of Blanchard and Fischer by starting the book with a simple two-period utility maximizing problem for a consumer and goes on to use this inter-temporal framework to redefine current account with the help of economy's intertemporal budget constraint. A conventional open economy macroeconomics book would define current account as income less absorption (a more precise national accounting definition of current account as income less absorption *plus* net unilateral transfers is seldom found in textbooks). Alternatively, the current account is defined through balance of payment accounting as trade balance *plus* net factor payments *plus* net unilateral transfers. Many modern textbooks do give a third alternative of defining current account as saving-investment gap. More precisely, current account so defined would equal private saving less private investment plus public saving less public investment *plus* statistical discrepancy. Obstfeld and Rogoff's interpretation of current account falls in none of the above three categories. They do exploit the third definition, which does relate current account gaps to intertemporal choice between consumption and

investment, but extends it to smoothing in a multi-period or overlapping generation framework. The current account (CA) is defined as accretion to economy's net foreign assets (B) during a year in this framework. The accretion is financed by income earned by production (Y), plus interest income earned at the interest rate (r) on foreign assets acquired previously less consumption (C).

$$CA_t = B_{t+1} - B_t = Y_t + r_tB_t - C_t$$

In a two-period case under the assumption of zero initial and terminal foreign assets and considering the budget constraint restricting the present value of consumption equal to the present value of output, the current account balance would take the form:

$$\begin{aligned} CA_2 &= Y_2 + r_2B_2 - C_2 = Y_2 + r_2 (Y_1 - C_1) - C_2 \\ &= - (Y_1 - C_1) = - B_2 = - CA_1 \end{aligned}$$

Combining the representative individual's indifference curves with intertemporal budget constraint one may obtain a diagrammatic derivation of a small economy's equilibrium and the implied trajectory of its current account. This would show that nations may improve welfare of their citizens by running current account deficits or surpluses, and current account imbalances *per se* may not be bad. The text goes on to discuss the dynamics of current account and Deaton's paradox.

For those having studied macroeconomics and international finance even a few years before the publication of this book, there would be plenty of matter that is new. It extends an OLG –like. framework to a small economy with many periods, providing an explanation of gains from trade between two periods, as also deriving the transversality conditions to obtain a picture of the nation's bankruptcy. The no-ponzi game conditions are of great relevance in understanding the macroeconomics of financial markets. Obstfeld and Rogoff, like Blanchard and Fischer also analyze speculative asset price bubbles, but they approach it from the side of open economy financial markets. Blanchard and Fischer extends micro-foundations to understand output fluctuations, consumption

smoothing and business cycles. Obstfeld and Rogoff in an analogous framework analyse the literature which relate output shocks and consumption smoothing to the dynamics of current account. The framework later helps build up several interesting insights. They apply the budget deficit in an OLG framework to introduce generational accounting and to seek answer to the question whether government budget deficits cause current account deficits? They also bring to the readers the cash-in-advance framework, but extend its focus to go beyond that by Blanchard and Fischer by portraying two-country cash in advance model. This open economy framework facilitates the discussion of pegs, target zones, speculative attacks and currency substitution.

For those who are keen to understand the macroeconomics of foreign exchange intervention, Obstfeld and Rogoff's book is indeed a compelling treatise. The book provides a comprehensive treatment of models of speculative attack, which may not be dictated by fundamentals but by credibility of monetary policy. The Kydland-Prescott, Barro-Gordon models are revisited and extended in open economy framework. Rogoff's seminal contribution on the conservative central banker is integrated in this setting to obtain an improved understanding of why central bank independence can be crucial even from the viewpoint of defence of pegs. On the one hand, the target zone literature is rigorously explained in the book, with neat derivations of the smooth pasting conditions. On the other, the basic model of monetary policy credibility is reinterpreted by making applications to an open economy in which purchasing power parity holds. Perhaps the authors rightly interpret the strand of literature originating from Krugman-Obstfeld debate, when they conclude that even if speculative attacks are driven by sunspots, countries with weak fundamentals are likely to be more vulnerable to them. Chapters 8-10 directly incorporate money in the models and provide understanding of this strand of literature.

The book is a compendium in a sense, almost complete in its coverage of literature. For those who find the book abstract, the intuitions and policy relevance is best obtained by skimping through the boxes. But the book is primarily a text for graduate studies

supporting frontier areas of research. Some supplements are provided to some of the chapters to facilitate understanding of the text by developing mathematical tools. It is difficult to say as to what is missing in the book. The only few aspects which may strike some, may include a near absence of discussion on the microstructure of the foreign exchange markets. The microstructure and international finance sizably influence the impact of open economy macroeconomics, or, to put it differently, international macroeconomic theories would yield an inadequate understanding of the policy impact, without an understanding of the microstructure. Similarly, the text covers the monetary policy coordination issues in reputational framework, but does not go far in covering the game theory literature as a possible adjunct. These may be small blips for some who are pursuing research in these specific class of models, but this in no way undermines the claim of the book to providing a treatise on the subject of international macroeconomics. The book is worth its high price and one wishes it retains its hardbound format, as it could well be the text for the next decade.

In 1990, N Gregory Mankiw observed that 20 years ago, it was easy to be a student of macroeconomics. Macroeconomists felt sure of the answers they gave. Seven years later, the subject matter has become even fuzzier in the backdrop of increased capital market integration. The ray of hope lies in the integrated treatment provided by Obstfeld and Rogoff. The book provides an encyclopedic and balanced account of the subject of international macroeconomy. It will surely take the Copernican revolution further.

**– Mridul Saggar***

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***The Macroeconomics of International Currencies : Theory, Policy and Evidence,* by Paul Mizen and Eric J. Pentecost, Edward Elgar Publishing Ltd., UK, 1996, pp. xxi + 259, £55.**

The conduct of monetary policy on the basis of empirically tested stable relationships between money, output and prices in an open and integrated trade and financial system has often led to non-realisation of monetary targets in several countries. Liberalisation of restrictions on cross border capital movement and progressive deepening and widening of financial systems are seen as factors which have imparted considerable instability to national money demand functions. A major source of instability has been the increasing degree of substitution between domestic and foreign currencies. Currency substitution, which existed since the days of bimetalism, gained importance for designing macro-economic policies only with the globalisation of financial systems which provided opportunities to economic agents to diversify their portfolios. Since unanticipated shifts in portfolios could considerably alter the relative demand for national currencies, in the new monetary economics tradition, currency substitution is recognised as a major determinant of money demand as well as an important potential source of exchange rate volatility. There is, however, lack of any unanimity on the interpretation and estimation of currency substitution and its policy implications. Against this background, the edited volume entitled "The Macroeconomics of International Currencies : Theory, Policy and Evidence" by Paul Mizen and Eric J. Pentecost provides a unique compilation of articles that gives a deep insight on this subject of emerging importance.

With "currency substitution" as the principal theme of the book, a whole gamut of issues relating to currency substitution has been addressed in twelve separate chapters with each chapter focusing on specific aspects of the broader theme. The introductory chapter highlights how the perceived independence of monetary policy in a flexible exchange rate system has been severely undermined by the

increasing degree of currency substitution. The interdependence of monetary policy that existed since the days of pure gold standard till the breakdown of the Bretton Woods system continues even now; rather, the degree of interdependence has increased because of the phenomenon of currency substitution. In Chapter two on "Currency substitution in theory and practice" by Mizen and Pentecost, various definitional and measurement issues are addressed followed by a discussion on how currency substitution could be modelled theoretically. Currency substitution has to be interpreted in the context of a situation when economic agents of one country hold a diversified portfolio comprising domestic money, domestic bonds, foreign money and foreign bonds. Any rebalancing of the portfolio in response to any exogenous shock may lead to substitution of one currency for the other and/or substitution of one bond for the other. While currency substitution strictly refers to substitution between two monies, substitution between bonds denominated in two monies is often referred to as capital mobility which at times however may, induce currency substitution. Currency substitution is a dynamic process since domestic currency is substituted partly or entirely by any foreign currency over time and during that process the degree of currency substitution changes. At the theoretical level currency substitution has been modelled either through monetary models or through global models that comprise restricted and unrestricted portfolio balance models. An advantage of the portfolio balance models is that it distinguishes between currency substitution (measured by the coefficient of the expected exchange rate change) and capital mobility (measured by the coefficient of the foreign interest rates). Despite the presence of divergent views on currency substitution the importance of international monetary policy coordination, according to Mizen and Pentecost, must be recognised since the objective in the presence of currency substitution would be to ensure the stability of relative prices and relative quantities of money rather than the stability of domestic prices and domestic monetary aggregates.

Highlighting the relevance of studying the impact of currency substitution for explaining the large exchange rate volatility during the post Bretton Woods period in Chapter three on "Direct and in-

direct concepts of international currency substitution", Ronald I. Mckinnon emphasises the need to distinguish direct substitution from indirect substitution for explaining the implications for monetary and exchange rate management. While direct substitution signifies that two or more currencies compete with each other while circulating in one national economy as a means of payment, indirect substitution refers to switching between financial assets denominated in different currencies. Under conditions of direct substitution, exchange rates must reflect instantaneous PPP since deviation from PPP would lead to shift in demand from one currency to the other for financing the relevant transaction. Analogously, under conditions of indirect substitution, exchange rates must instantaneously reflect interest parity conditions since deviations from the parity conditions would result in shift in demand for securities denominated in different currencies. When residents have the option to finance any transaction by using either of the currencies and to save in instruments denominated in either currency, the demand for either currency would be unstable and thereby contribute to exchange rate volatility. McKinnon therefore suggests that under conditions of high degree of currency substitution, a fixed exchange rate policy that ensures that the monetary authority would withdraw one money from circulation as the other one is injected (i.e. non-sterilised intervention) may prevent extreme currency volatility. When two fiat monies circulate simultaneously and compete as medium of transactions, "Gresham's Law II", which indicates response exactly opposite to that of the "Gresham's Law", would make the stronger currency to drive the weaker currency out of circulation. In countries which rely on significant inflationary taxes to cover deficits, currency substitution may erode the tax base and hence as a second best approach such countries could pursue a policy of capital controls with a crawling exchange rate peg. With improvement in the fiscal balance position (i.e. no inflation tax), fixing exchange rate as a nominal anchor would be the appropriate policy. With exchange rate as a nominal anchor, the central bank could adjust its monetary base in response to shifting direct and indirect demand for it i.e., it could expand money supply above the standard norm when domestic currency appreciates and contract money supply during periods of depreciation. According to

McKinnon for a small open economy such an exchange rate rule in itself would maintain monetary equilibrium.

Simultaneous circulation of more than one currency in economies would necessarily involve physical movement of currencies cross border, which in turn would affect the size of money stock in all these economies. Cocirculating currencies are however mostly not recorded in national estimates of money stock and capital flows and many even do not recognise their importance while designing monetary, financial and balance of payments policies. In Chapter four on "Measurement of cocirculation of currencies", Rusell Krueger and Jiming Ha suggest several methods for estimating inward and outward flows of currencies and stress the importance of collection of statistics on cocirculating currencies for formulation of domestic policies. They observe that estimating the amount of domestic currency leaving a country for use abroad is easier to estimate compared to measuring the inflows of foreign currencies into the country. Surveys on per capita holdings of domestic currencies is one method which could help in explaining unexplained currency growth during any period which in turn may be interpreted as the amount of physical outflow of domestic currency. Similar surveys could also be conducted to track per capita holding of foreign currencies. Methods suggested by Krueger and Ha, however, would explain, at best, only a small part of currency substitution i.e. which are held in the form of foreign currencies; a greater part of the substitution actually takes the form of foreign currency deposits held abroad/convertible deposits held within the banking system and even investments in foreign financial assets.

In Chapter five on "Currency substitution, seigniorage and the choice of currency policies", Thomas D. Willett and King Banaian explain how currency substitution operates as a major constraint for governments in generating seigniorage revenue and suggest what could be an optimal tax policy when inflation reduces the base on which seigniorage tax is levied in the presence of currency substitution. Governments which fail to reduce their reliance on the inflation tax often attempt to insulate the impact of currency substitution on seigniorage revenue collection by introducing capital con-

trols, by prescribing high reserve requirements and/or by resorting to various types of financial repression measures. At the policy level, currency substitution may be desirable from the standpoint of restricting governments from excessive use of inflationary financing, but in a flexible exchange rate regime currency substitution could have significant destabilising impact on the exchange rate. The optimal policy response, therefore, could well be to maintain pegged exchange rates and to surrender the ability to choose the level of seigniorage that a country may prefer. The extreme form of exchange rate pegging; i.e. a currency board system would enable governments to mobilise seigniorage revenue from the issue of domestic currency while earning interest on the foreign reserve holdings. Inflation disciplining charcteristics of pegged /fixed exchange rates however may have several limitations as well. Willett and Banaian thus emphasize that, at the policy level, the implication of currency substitution for choice of exchange rate regime and seigniorage policies must be properly recognised.

Analysis of currency substitution in a historical perspective would indicate that while supply side substitution has been an integral element of international trade and finance for centuries, demand side substitution assumed importance only in the later half of the present century with substantial improvements in the depth and sophistication of international financial markets. Highlighting this aspect in Chapter six on "Currency substitution, the yield curve and North American monetary policy", Russell S. Boyer observes that use of fixed exchange rates is the most obvious example of supply side substitution with the US system of money supply in which 12 regional Federal Reserve banks issue currencies representing perfect substitution from the supply side. After the breakdown of the Bretton Woods system, managed floating exchange rate regimes continue to indicate limited supply side substitutability but demand side substitutability has assumed ascendancy. The near random walk behaviour of key exchange rates and the tendency of yields on financial assets denominated in different currencies and domestic inflation rates to converge signify the presence of demand side substitution under which portfolio managers diversify their investments across currencies and financial assets when opportunities are opened

to them to hold an international portfolio. For the conduct of monetary policy segregating supply side substitution from demand side substitution becomes essential and empirically, according to Boyer, estimating the degree of convergence between short-term interest rates (representing supply side substitution) and long-term interest rates (representing demand side substitution) could offer a rough approximation. The rationale behind such an approximation is that short term rates are mostly influenced by central banks whereas long term rates respond mostly to the decisions of portfolio managers. Using the relevant segments of yield curves of five OECD countries Boyer finds high demand side and supply side substitution between the US dollar and the Canadian dollar, relative to other pairs of currencies. While the high degree of unrestricted capital mobility between the USA and Canada explains the demand side substitution, the Canadian exchange rate regime (which was highly managed for almost 85 per cent of the period considered by Boyer) largely explains the supply side substitution. The high degree of currency substitutability, however, has considerable implications for the independence of monetary policy with respect to inflation and interest rates, particularly for Canada. Any instability in the domestic monetary system triggered by demand side substitution could be moderated by changing the degree of supply side substitution which, however, would involve a high degree of exchange rate management.

The dollarisation ratio i.e. domestic holdings of dollar deposits by residents to holdings of domestic currency deposits is generally treated as an important indicator for designing policies by the monetary authorities of open economies. In Chapter seven on "The currency substitution hypothesis and relative money demand in Mexico and Canada", John H. Rogers uses several models to estimate relative money demand functions for Mexico and Canada and underscores the relevance of the dollarisation ratio for the conduct of monetary policy. Beginning 1977, the Mexican monetary authority permitted residents to hold deposits in dollars (known generally as Mexdollar deposits) which had the backing of central bank's reserves. The objective behind Mexdollar deposits was essentially to stem short term capital flight. As per the standard literature on

currency substitution, under situations of expected large depreciation of domestic currency there should be a shift in residents preference for higher dollar deposits. But in all the models used by Rogers, periods of expected Mexican peso depreciation were associated with a significant decline in demand for Mexdollar deposits. This inverse relationship between expected depreciation and dollarisation ratio in Mexico (contrary to the positive relationship for Canada) could be ascribed to the convertibility risks associated with the Mexdollar deposits. During periods of large expected depreciation, Mexico's reserve level generally fell below the critical minimum level and the fear among residents that the Mexican central bank at any point could convert Mexdollars into peso deposits motivated them to withdraw from their Mexdollar deposits for conversion into dollars. In fact in 1982, amidst the severe external debt crisis, the Mexican authorities converted all Mexdollar deposits into peso deposits at an exchange rate which was below the market clearing rate. The Mexican experience may not be unique since in many other economies also the convertibility risk may be present. The credibility of the exchange rate policy, maintenance of reserve levels consistent with various reserve adequacy indicators in an open economy and no direct backing of the residents' domestic dollar deposits by the country's foreign exchange reserves thus assume importance from a policy perspective.

In Chapter eight on "Currency substitution in European financial markets", Michael J. Artis observes that in view of the large cross-border currency-substitution deposits in EC member countries, analysis of money demand instability resulting from currency substitution among EC member currencies may not be appropriate. When large deposits of non-domestic currency denomination are held in member countries, conventionally defined money supply data may not help in making useful monetary analysis. A more meaningful approach to test the existence of currency substitutability in EC member countries would involve testing the stability of a Europe wide money demand function. Aggregation over a larger geographical area covering economies which have open trade and financial transactions with each other may help in internalising the currency substitution shocks to a large extent and as a result the combined

money demand function may turn out to be relatively stable. In the EC money-demand function considered by Artis, aggregate of national money supplies is a function of prices, output, interest rates and a currency substitution term proxied by US dollar/ECU exchange rate representing substitutability between US dollar and ECU and not among the currencies of ECU. Recognising the problem of aggregation in the EC context, Artis uses alternative aggregation principles. Econometric findings of the model reasonably support both the hypotheses that the aggregate money demand is more stable and that area wide money supply analysis may be more useful for monitoring domestic inflation. Artis, however, cautions that the econometric results could also have valid alternative interpretations and in the absence of adequate research work on the issue nothing could be interpreted conclusively even if supported by empirical findings.

The conduct of monetary policy on the basis of empirically tested stable relationships between money, output and prices in Germany does not take into consideration the impact of currency substitution and this could partly explain the overshooting of the money stock target that the Bundesbank has been experiencing since the unification of Germany in 1990. Highlighting this aspect in Chapter nine on "Currency substitution and the demand for Deutsche marks before and after the fall of the Berlin Wall", Gianna Boero and Giuseppe Tullio estimate money demand functions for Germany for the pre and post unifiction period by including additional variables and proxies for currency substitution along with the standard variables used by the Bundesbank in setting its M3 targets. Besides the domestic real growth, the Bundesbank considers an unavoidable inflation rate of 2 per cent and a trend annual decline of 0.5 per cent in velocity for estimating the desired growth of M3 and a +/- one per cent band around the desired level is set as the target. Since the Bundesbank does not take into consideration important determinants of demand for real M3 such as changed perception about the credibility of ERM, impact of increasing financial market integration, and currency substitution, the substantial overshooting of the money stock particularly in the first half of 1994 could be ascribed to the instability of the money

demand arising on account of incomplete specification. In the estimates generated by Boero and Tullio for the pre unification period, they find that inclusion of additional variables improve the explanatory power and relative stability of the money demand with the coefficient for currency substitution turning out to be highly significant. When they extend the period of estimation to include the post unification period the importance of currency substitution for the money demand analysis increases; however, despite the use of several dummy variables to approximate the post unification period the money demand function does not indicate stability for the post unification period. Boero and Tullio observe that such instability could possibly be due to the initial impact of the unification shock on the German money demand which may take several years to die out.

Unlike the high degree of currency substitution exhibited among the EC currencies and the US dollar/DM the Japánese yen, despite Japan's emergence in the eighties as a major international financial centre, does not show any significant currency substitution both outside and within Japan. George S. Tavlas in Chapter ten on "Currency substitution and the international demand for yen" tries to identify the factors behind low currency substitution of the yen and the failure of Japan to emerge as an international banker. International use of the yen was almost discouraged as a matter of policy by the Japanese monetary authorities till the seventies, fearing loss of control over money supply and the exchange rate. In the eighties, however, several measures were instituted to liberalise the domestic financial sector as also restrictions on capital transactions and large current account surpluses in the face of deceleration of demand for domestic investment in the private sector in the aftermath of the oil shock made the country to emerge as the largest net international supplier of capital. Net long term capital flows from Japan were, however, invested in securities denominated in currencies other than yen. As a result, despite being the largest supplier of capital Japan could not emerge as an international banker. For a country to serve as an international banker it must accept liquid liabilities denominated in its own currency and transform such liabilities into a large number of longer term loans and

investments denominated also in its own currency. The role of pound sterling in the late nineteenth and early twentieth centuries and that of the US dollar in the post world period helped the two nations to emerge as international bankers. Econometric exercise conducted by Tavlas indicate the absence of any significant currency substitution between the yen and the US dollar. Information collected by Tavlas on foreign yen claims under (a) claims held in Japan by non-residents, (b) claims held outside Japan by non-residents in the form of short term Euro-yen deposits and (c) claims held outside by non-residents in the form of long term Euro-yen bonds also support the findings of the econometric exercise. The use of yen among several Asian countries has increased in recent years but, according to Tavlas, the prospects of a yen currency bloc emerging in the near future is highly unlikely. While US continues to be the largest debtor with Japan as the largest international creditor, the importance of the US dollar is unlikely to diminish until Japan takes measures to emerge as an international banker.

While internationalisation of the Japanese yen has progressed only moderately there has been significant dollarisation of the economies experiencing high inflation and severe macro-economic imbalances. In Chapter eleven on "Dollarisation in transition economies : evidence and policy implications", Ratna Sahay and Carlos A. Vegh examine the factors behind excessive dollarisation of 15 transition economies of Eastern Europe and highlight the problems of macroeconomic management under conditions of high degree of dollarisation. Despite financial repression in these economies prior to the reform years of nineties, there was no significant dollarisation of these economies due to tight controls on foreign exchange and the domestic financial sector. In the face of the move to institute large scale market oriented reforms in the nineties which involved significant removal of exchange and payments restrictions, the inability to contain inflation at moderate levels and the lack of alternative saving instruments fetching market related interest rates resulted in displacement of domestic currency by foreign currency as a store of value. As high inflation continued, several commodities were even quoted in foreign currency signifying

that the demand for foreign currency even started emerging as a medium of exchange and a unit of account. Countries with relatively fixed exchange rate regimes experienced low dollarisation ratios compared to countries with more flexible exchange rate regimes. In Russia, not only did the dollarisation ratio rise from about 15 per cent in December 1991 to about 45 per cent by mid-1993 and hovered around 35-40 per cent thereafter, but the currency-to-deposit ratio also increased during the reform years indicating the lack of public confidence in the banking system and the increasing reluctance to hold domestic currency deposits. Many of these economies also experienced hysteresis in dollarisation ratio; i.e. the dollarisation ratios did not fall despite considerable decline in the inflation rates in these economies. Basic monetary aggregates used by the monetary authorities also included dollar deposits in domestic currency terms on which, however, the monetary authorities had little control. The resultant endogenisation of the money supply created problems for the authorities in their attempt to contain inflation by controlling the domestic component of the money supply. In view of the loss of effectiveness of monetary policy, according to Sahay and Vegh, targetting monetary aggregates in a highly dollarised economy may not be advisable and an exchange rate anchor may actually be desirable.

The dollarisation process in several Latin American countries essentially reflects the adaptation of the economies to prolonged periods of chronic inflation and severe macro economic imbalances. The importance of foreign currency as a superior inflation hedge and the inability of domestic financial markets to adapt to a high inflation environment by offering fairly liquid high yielding saving instruments mostly explain the flight from domestic money in favour of foreign currencies in these economies. The pattern and macro-economic inplications of the process of dollarisation may, however, be different for countries with strict capital controls from those in which residents can hold foreign currency deposits or where foreign currency has (quasi) legal tender status, observes Miguel A. Savastano in Chapter twelve on "Dollarisation in Latin America : recent evidence and policy issues". The dollarisation process in countries with capital controls would be reflected in the

holding of foreign currency assets abroad and of foreign currency notes outside the banking system; any shift in the pattern of currency substitution could drain foreign currencies from the formal sector. Dollarisation process in countries where residents are permitted to hold convertible foreign currency deposits would in turn depend largely on the strength of macroeconomic policies, credibility of foreign exchange regime, and exchange rate stability. More than the dollarisation index the composition of dollar holdings (i.e. whether in the form of convertible deposits with domestic banks, foreign currency deposits abroad, or foreign currency notes) are important for evaluating macroeconomic consequences as the allocation of the total non-domestic currency holdings would influence domestic money and foreign exchange markets. Shifts in the alternative avenues of holding foreign currencies could be monitored through the movement of the velocity of money since flight from domestic money may not necessarily imply flight from the domestic financial system. Currency substitution that increases the demand for holdings of convertible deposits within the banking system would not change the level of financial intermediation and hence may not alter the velocity. Increase in demand for deposits to be held abroad would however represent a flight from the domestic financial system and hence may alter velocity. The composition of dollarisation could also help in assessing the hysteresis phenomenon. In several of the Latin American countries following improvements in macro economic fundamentals there have been reverse flight of capital; but such inflows were held in the form of convertible deposits with domestic banks instead of being converted into domestic currencies and as a result, the dollarisation ratios did not exhibit any perceptible decline. According to Savastano, it is not yet clear however whether the money demand hysteresis phenomenon experienced in some of the Latin American countries is a transitory or a permanent phenomenon.

The issues addressed in the book are extremely useful from the point of view of countries which continue to maintain restrictions on capital transactions but are expected to progressively liberalise their capital account and move in the direction of attaining capital account convertibility. Removal of restrictions on out-

ward flows that would allow residents to hold foreign currency deposits/currencies as a store of value would necessitate considering foreign interest rate and the exchange rate as major determinants of domestic money demand. It would also require reducing reliance on inflationary financing to negligible levels since inflation tax would be avoided by residents through currency substitution. Maintaining low inflation with an open capital account would be critical since high inflation for a longer period may make foreign currencies substitute domestic currency even as a medium of exchange and a unit of account. A sound domestic financial system that offers credible saving instruments as inflation hedges and enjoys the confidence of the residents would also be a crucial precondition to discourage flight from the domestic currency. Overshooting of monetary targets should not be interpreted as temporary phenomena since instability in money demand resulting from currency substitution could be a permanent feature. For improving the effectiveness of policies, timely collection of statistics on currency substitution must be emphasised. If exchange rate is not managed and left to be determined entirely by the market forces, then any unanticipated shifts in the degree of currency substitution could be reflected in the form of large exchange rate volatility. Managed exchange rate, however, may not be sustainable in the face of unrestricted cross border capital flows and hence the approach should be in favour of greater exchange rate flexibility. What should be the appropriate stance of exchange rate policy in the context of an open capital account is not yet firmly established. Nevertheless, authorities must use available information on currency substitution while designing their country specific exchange rate policies.

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**Notes**

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