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The Relationship Between Risk and Capital: Evidence from Indian Public Sector Banks

Abhiman Das and Saibal Ghosh*

The study investigates the relationship between changes in risk and capital in the public sector banking system in India, using both the seemingly unrelated regression (SUR) and the two stage least square (2SLS) method of estimation. Empirical findings establish a negative and significant impact of size on capital, indicating that large banks increased their ratio of capital to risk weighted assets less than other banks. Regulatory pressure is also found to have a negative and significant impact on the ratio of capital to risk weighted assets. *Ceteris paribus*, adequately capitalised banks decrease their capital ratio more prominently than other banks.

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Introduction

The decade of the seventies witnessed a significant decline in the capital ratios of many banks, especially in the G-10 countries. In an attempt to reverse this decline, the bank regulators issued explicit capital standards for banks (and bank holding companies, as in the United States) in December 1981. These standards required banks to hold a fixed percentage of their total assets as capital. Although these minimum regulatory capital standards have been credited for increasing bank capital levels[1], the 1980s witnessed a significant number of bank failures. As observed by Lindgren *et al.* (1996), since 1980, over 130 countries, comprising almost three-fourths of IMF's member countries have experienced significant banking problems.

The widespread criticism about declining capital standards of banks and the consequent bank failures led the Basel Committee

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on Banking Supervision (BCBS) to announce the adoption of risk-based capital standards in 1989. The primary purpose of these standards was to make capital requirements of banks responsive to the risk in the asset portfolio of banks. Although capital ratios at commercial banks have increased since the risk-based standards took effect, the question arose as to what degree these increases are a response to risk-based capital. Furthermore, although the adoption of risk-based standards have focused attention on capital levels and bank lending, insufficient attention was given as to how the adoption of the risk-based standards may impact bank-portfolio risk levels.[2]

Most of the work in this area examines the impact of risk-based standards on capital and risk during a particular period (Shrieves and Dahl, 1992; Jacques and Nigro, 1997). In contrast to these studies, the present paper employs a seemingly unrelated regression (SUR) approach to examine the inter-relationships among bank capital, portfolio risk and the risk-based capital standards over the period 1995-96 to 2000-01. By using SUR technique, the model not only explicitly recognises the endogeneity of changes in capital and risk, but also takes cognisance of the fact that the errors in the equation might be contemporaneously correlated and as such, is preferable to the single equation Ordinary Least Squares (OLS) approach, which assume either capital or risk as exogenous to the bank or assume no correlation in the error structure. In order to test the robustness of the results, the model also employs the two-stage least squares (2SLS) technique. The advantage of the 2SLS technique lies in the fact that it recognises the simultaneity of banks' adjustment in capital and risk and to obtain asymptotically efficient estimates.

The remainder of the paper is organised as follows. The following section examines the available literature in this regard. Section II describes the institutional structure of the Indian banking system. The subsequent two sections discuss the risk-based standards and their limitations. The framework of the model is outlined in section V. The estimation procedure and a discussion of the results are contained in section VI. Finally, the concluding remarks are gathered in section VII.

Section I

Review of Literature

Recent papers have attempted to provide some evidence as to whether banks change the composition of their assets when they face a binding capital constraint, substituting away from high risk-weighted assets. Using data on 1,800 Federal Deposit Insurance Corporation (FDIC) insured banks in the period 1983-87, Shrieves and Dahl (1992) found that banks with capital to assets ratio less than 7 per cent applied by the US authorities at that time increased their ratio on an average by 140 basis points per annum more than other banks. Subsequently, Aggarwal and Jacques (1998) repeated the analysis of Shrieves and Dahl, using cross-sectional US bank data for 1991, 1992 and 1993. They were particularly interested in the impact of bank behaviour of the 1991 Federal Deposit Insurance Corporation Improvement Act (FDICIA) legislation and the prompt corrective action provisions laid down. These provisions obliged supervisors to take specific actions when a bank's capital ratios fell below certain trigger levels. They found that banks in the undercapitalised categories increase their capital target ratios more quickly than other banks with higher initial capital.[3] Using a three-stage least squares (3SLS) framework, Jacques and Nigro (1997) analysed the relation between bank capital, portfolio risk and the risk-based standards. Their results suggested that the median bank reduced its portfolio risk by 3.49 percentage points over the period 1990 to 1991 as a result of the regulatory pressure brought about by the risk-based standards.

Most of the above studies pertain to the banking industry in the US. Two exceptions in this context are Ediz *et al*. (1998) and Rime (2001). The former study employed quarterly data on 94 US banks over the period 1989:Q1 to 1995:Q4, while the latter study used annual data on 154 Swiss banks between 1989 and 1995. The two papers adopted broadly similar specifications. In particular, both introduced among the independent variables dummies for capital pressure, which equals unity when a bank's capital ratio falls into a zone starting above the regulatory minimum. The gap between the starting point of the zone and the regulatory minimum varies across banks and is taken to be proportional to the time-series

standard deviation of the bank's own capital ratio. Both papers found regulation to be effective in the sense that the dummy variable in their setup had statistically and economically significant coefficients. In the case of Ediz *et al*. (1998), the ratio of capital to risk-adjusted assets increased by 44 basis points per quarter more for banks in the regulatory pressure zone compared to adequately capitalised banks. In the study by Rime (2001), the impact of regulation (*i.e*., of a dummy for the capital ratio less than one standard deviation above the regulatory minimum) was statistically significant at the one per cent level, although the magnitude was very small.

Section II

Institutional Structure of the Indian Banking System

The scheduled commercial banking system comprises of the foreign banks operating in India, in addition to Indian banks in the public and the private sectors and the Regional Rural Banks. The two rounds of nationalisation-first in 1969 of 14 major private sector banks with deposit liability of Rs. 0.50 billion or more, and thereafter in 1980, of 6 major private sector banks with deposits not less than Rs.2 billion[4] - led to the creation of Public Sector Banks (PSBs) with nearly 92 per cent of assets as at end-March 1991. While there were several private sector and foreign banks functioning at that time, there activities were highly restricted through branch licensing and entry regulation norms.

All commercial banks, whether public, private or foreign, are regulated by the central bank, the Reserve Bank of India (RBI). A process of liberalisation of the financial sector was initiated in 1992, which aimed at creating a more diversified, profitable, efficient and resilient banking system, based on the recommendations of the Narasimham Committee on Financial Sector Reforms (1991). The underlying philosophy was to make the banking system more responsive to changes in the market environment and to that end, engendered a shift in the role of the RBI from micro-management of bank's operations to macro governance.

The reforms sought to improve bank profitability by lowering pre-emptions (through reductions in the cash reserve and statutory liquidity ratios)[5] and to strengthen the banking system through institution of 8 per cent capital adequacy norms, in addition to income recognition, asset classification and provisioning requirements in line with international best practices. Competition was sought to be promoted through entry of new banks in the private sector and more liberal entry of foreign banks. While regulations relating to interest rate policy, prudential norms and reserve requirements have been applied uniformly across bank groups, priority sector credit requirements are quite varied for different categories of banks. Illustratively, while the public sector and private sector banks are required to allocate 40 per cent of their credit to priority sectors (comprising, agriculture, small-scale industry, transport operators, small business, *etc*.), the same for foreign banks stands at 32 per cent. These amounts, for both the public/private and the foreign banks are inclusive of several sub-targets, the former comprising a sub-target of 18 per cent for agriculture, while the latter consists of a sub-target of 10 per cent for exports[6] and 10 per cent for small-scale industries.

Until 1991-92, all PSBs were fully owned by the Government.[7] After the reforms process was initiated, these banks were allowed to access the capital market to raise up to 49 per cent of their equity. Till 2000-01, as many as 12 PSBs accessed to capital market and raised an amount aggregating Rs.64 billion.

Evidence of competitive pressures on the Indian banking industry is evidenced from the decline in the five-bank asset concentration ratio[8] from 0.51 in 1991-92 to 0.44 in 1995-96 and thereafter to 0.41 in 2000-01 and by the increasing number of private and foreign banks (Table 1)[9].

Table 1: Summary of the Banking Industry: 1990-91 to 2000-01

Year /	1990-91			1995-96			2000-01		
Bank Group	**Pub.**	**Pvt.**	**Forgn.**	**Pub.**	**Pvt.**	**Forgn.**	**Pub.**	**Pvt.**	**Forgn.**
No. of Banks	28	25	23	27	35	29	27	32	41
Total Deposits (Rs. billion)	2087.3	94.3	84.5	3908.2	361.7	306.1	8593.8	1349.2	591.9
Total credit (Rs.billion)	1305.7	49.5	50.6	2075.4	219.3	225.0	4146.3	672.1	429.9
Credit-deposit ratio	0.63	0.52	0.60	0.53	0.61	0.75	0.48	0.50	0.73
Share of									
Total Deposits	92.1	4.2	3.7	85.4	7.9	6.7	81.6	12.8	5.6
Total Credit	92.9	3.5	3.6	82.4	8.7	8.9	79.0	12.8	8.2
Total Income (Rs. billion)	240.4	10.4	15.3	536.7	71.8	74.99	1034.9	163.9	119.8
Net Profit (Rs. billion)	4.7	0.4	1.5	-3.3	15.9	7.4	43.2	12.3	10.2

Pub. Public-sector Banks; Pvt. Private Sector Banks; Forgn: Foreign Banks

The performance of PSBs has become more responsive to changes in the marketplace, with growing emphasis on profitability as an indicator of performance as opposed to non-commercial considerations in the pre-reform era. Illustratively, there was a distinct improvement in the net profit of PSBs (from 4.6 billion in 1992-93 to Rs.43.2 billion in 2000-01). Reflecting the efficiency of the intermediation process, there has been a decline in the spread as attested by the ratio of net interest income to total assets from 3.20 per cent in 1990-91 to 2.84 per cent in 2000-01.

Section III

Risk-Based Standards: The Indian Experience

Capital adequacy has traditionally been regarded as a sign of strength of the financial system in India. In terms of Section 17 of the Banking Regulation Act, 1949, every banking company incorporated in India is required to create a reserve fund and has recently been advised to transfer a sum equivalent to not less than 25 per cent of its disclosed profits to the reserve fund every year.

A capital to risk-weighted assets system was introduced for banks in India since April 1992, in conformity with international standards, under which banks were required to achieve 8 per cent capital to risk weighted-assets ratio. Indian banks with branches abroad were given time till March 31, 1994 (subsequently extended to March 31, 1995) to achieve the norm of 8 per cent CRAR; the capital was to comprise of tier I plus tier II capital, of which tier II should not exceed 100 per cent of tier I. Accordingly, the pattern of assigning risk weights and credit conversion factors were also delineated, broadly in line with those in the original Accord.[10]

Although the switchover to stringent prudential regime did affect the banking system in the initial years, the system exhibited adequate resilience to record substantial improvements in financial strength through higher CRAR over the period. Data for public sector banks reveal that as on March 1996, while only 19 banks satisfied the CRAR of 8 per cent and above (the overall capital adequacy of PSBs was 8.72 per cent), the number increased to 26 in 1999. As at end-March 2001, as many as 25 out of the 27 public sector banks complied with the minimum CRAR of 9 per cent, with the overall capital adequacy of PSBs having increased to 11.20 per cent.

Section IV

Limitations of Risk-Based Capital Standards

Under an ideal risk-based capital system, any increase in the bank's portfolio risk would be accompanied by an increase in capital to act as a buffer against possible losses arising from the additional risks. This implies that the risk-based capital standards should explicitly link changes in required bank capital with changes in earnings exposure risk. However, conceptual weaknesses in the risk-based standards may undermine the relationship between changes in portfolio risk and changes in required capital. One reason for this is that the current risk-based capital standards account primarily for credit risk. Thus, a capital deficient bank can, at the margin, improve its risk-based capital ratio by substituting low credit risk assets, such as Government bonds, for shorter term and relatively interest-sensitive assets, such as commercial loans. Furthermore,

other types of risks, such as interest rate risks, credit concentration risks, are not explicitly recognised by the risk-based standards. Last, but not the least, the risk-based capital standards overlook potential interactions between individual assets. Portfolio theory suggests that the relevant risk of an asset depends not only on its own variability, but also its covariance with other assets in the portfolio. The risk-based standards unfortunately fail to incorporate the latter[11].

Section V

Model Specification

The preceding sections suggest that a relationship exists between bank capital and portfolio risk, and that the risk-based capital standards may have an impact on both capital and risk. To examine these issues, the simultaneous equations model developed by Shrieves and Dahl (1992) has been modified to incorporate the risk-based capital standards. In that framework, observed changes in bank capital and risk level are decomposed into two components: a discretionary adjustment and a change caused by factors exogenous to the bank such that:

$$\Delta CAP_{j,t} = \Delta^d CAP_{j,t} + E_{j,t} \quad (1)$$

$$\Delta RISK_{j,t} = \Delta^d RISK_{j,t} + U_{j,t} \quad (2)$$

where ΔCAP and ΔRISK are observed changes in capital ratios and risk levels for bank j in period t, Δ^dCAP and Δ^dRISK represent discretionary adjustments in capital ratios and risk levels and E and U are exogenously determined random shocks. In any period, banks may not be able to adjust their desired capital and risk levels instantaneously. Therefore, the discretionary changes in capital and risk is modeled using the partial adjustment framework, such that,

$$\Delta^d CAP_{j,t} = \alpha(CAP^*_{j,t} - CAP_{j,t-1}) \quad (3)$$

$$\Delta^d RISK_{j,t} = \beta(RISK^*_{j,t} - RISK_{j,t-1}) \quad (4)$$

where $CAP^{*}_{j,t}$ and $RISK^{*}_{j,t,}$ are the target capital and risk levels, respectively and α and β are parameters. In the partial adjustment framework, the discretionary changes in capital and risk are proportional to the difference between the target level and the level existing in period (t-1). Substituting equations (3) and (4) into equations (1) and (2), the changes in capital and risk can be written as:

$$\Delta CAP_{j,t} = \alpha(CAP^{*}{}_{j,t} - CAP_{j,t-1}) + E_{j,t} \quad (5)$$

$$\Delta RISK_{j,t} = \beta(RISK^{*}{}_{j,t} - RISK_{j,t-1}) + U_{j,t} \quad (6)$$

V.1 Definitions of Capital and Risk

We use the following definition of capital: the ratio of capital to risk weighted assets. This is slightly different from Shrieves and Dahl (1992) who also employ the ratio of capital to total assets as a measure of capital. In contrast, Rime (2001) employs both definitions of capital.

The measurement of risk, on the other hand, is subject to debate. In line with the standard work in this area (Shrieves and Dahl, 1992; Jacques and Nigro, 1997), we employ the ratio of risk-weighted assets to total assets (RWA) as a measure of risk. The rationale for using this measure is that portfolio risk is primarily determined by the allocation of asset across different risk categories. Although the use of RWA as a measure of risk has the advantage of reflecting the banks' decisions on risk taking with timeliness, it, however, pre-supposes that the risk-weights correctly reflect the economic risk of the different asset categories, which might not be necessarily valid in practice.

V.2 Variables Affecting Changes in Bank Capital and Risk

Equations (5) and (6) predict that observed changes in capital and risk in period t are a function of the target capital and risk levels, lagged capital and risk levels and exogenous factors. The target levels of capital and risk are unobservable and assumed to depend on a set of observable variables. It is to these variables that we turn next.

V.2.1 Size

Size may influence target capital and risk levels due to its relationship with risk diversification, investment opportunities and access to equity capital. The natural logarithm of total assets (LNSIZE) is included in the capital and risk equations to capture size effects.

V.2.2 Current Profits

Current profits may have a positive impact on banks' capital if financial institutions prefer to increase capital through retained earnings than through equity issues, as the latter may convey negative information to the market about the bank's charter value in the presence of asymmetric information. This runs contrary to Jacques and Nigro (1997), who employ the income in the previous period as a proxy for profitability in the current period. However, unlike their study, we employ the Return on Assets (RoA) in the capital equation as a proxy for profitability.

V.2.3 Non-Performing Loans

In the Indian context, studies on non-performing loans (NPLs) suggests that it has a sizeable overhang component arising from infirmities in the existing processes of debt recovery, inadequate legal provisions on foreclosure and bankruptcy and difficulties in the execution of court decrees. Banks also face external constraints such as the dominance of traditional industries in credit portfolios, industrial sickness and labour problems. It has also been observed that several internal factors (diversion of funds for expansion/ modernisation/diversification, inefficient management, strained labour relations and inappropriate technology) as well as external factors (recession, input/power shortage, price escalation) contribute to high NPLs. The level of NPLs tends to weigh down the bank's overall profitability and to that extent, increases the bank's loan loss provisioning. This, in turn, affects the ratio of risk-weighted assets (RWA) to total assets, as it leads to a decrease in the nominal amount of the RWA. Keeping this in view, change in non-performing assets (ΔNON) has been included in both the equations.[12]

V.2.4 Regulatory Pressure

The buffer theory predicts that a bank approaching the regulatory minimum capital ratio may have an incentive to boost capital and reduce risk in order to avoid the regulatory costs triggered by a breach of the capital requirements. However, poorly capitalised banks may also be tempted to take more risks in the hope that higher expected return will help them to increase their capital. We expect regulatory pressure to have a substantial impact on Indian public sector banks behaviour, given the strict supervisory and prudential norms followed by the central bank.

Regulatory pressure can be evaluated in several ways. Shrieves and Dahl (1992) adopt a probabilistic approach wherein the regulatory pressure variable (REG) is unity if the bank's capital is at least equal to the regulatory minimum and zero, otherwise. Ediz *et al.* (1998), on the other hand, adopt a relatively refined approach that reflects the impact of the capital ratio's volatility on the probability of failing to meet the legal requirements. Aggarwal and Jacques (1998), in contrast, measure regulatory pressure using Prompt Corrective Action (PCA) classification between adequately capitalised and undercapitalised categories.

We follow the approach of Shrieves and Dahl (1992) in our analysis. Accordingly, we construct a binary variable (REG), which reflects the degree of regulatory pressure. The variable is unity for banks with total capital ratios below 8 per cent, and zero, otherwise[13]. Additionally, since regulatory pressure may also affect the speed of adjustment of capital levels, therefore an interaction term defined as the product of the regulatory pressure variable and the capital level is included in the capital equation.

Combining our analysis, the target capital ratio (CAP^*) is influenced by a number of explanatory variables including: the natural logarithm of the size of the bank (LNSIZE), bank-wise return on assets (RoA), as a proxy for profitability (Rime, 2001), regulatory influence (REG), changes in non-performing assets ($\Delta NON_{j,t}$) and changes in risk ($\Delta RISK_{j,t}$). In a similar fashion, the target risk ratio (RISK*) is influenced by the natural logarithm of bank size (LNSIZE), regulatory pressure variable (REG), changes in capital ($\Delta CAP_{j,t}$), the composite

risk index in the earlier period ($RISK_{j,t-1}$) and changes in non-performing assets ($\Delta NON_{j,t}$).

Substituting linear functions of the natural logarithm of bank size (LNSIZE), regulatory influence (REG), return on asset (RoA) and the change in risk (capital) for the target capital (risk) level yields the model to be estimated, given by equations (7) and (8):

$$\Delta CAP_{j,t} = \lambda_o + \lambda_1 LNSIZE_{j,t} + \lambda_2 \Delta NON_{j,t} + \lambda_3 \Delta RISK_{j,t} + \lambda_4 RoA_{j,t} + \lambda_5 REG_{j,t} + \lambda_6 CAP_{j,t-1} + \lambda_7 REG_{j,t} \times CAP_{j,t-1} + \mu_{j,t} \quad (7)$$

$$\Delta RISK_{j,t} = \theta_o + \theta_1 LNSIZE_{j,t} + \theta_2 REG_{j,t} + \theta_3 \Delta CAP_{j,t} - \theta_4 RISK_{j,t-1} + \theta_5 \Delta NON_{j,t} + \psi_{j,t} \quad (8)$$

where μ and ψ are disturbance terms, assumed to be contemporaneously correlated.

Simultaneous estimation of these equations is carried out by the SUR process. Under the null hypothesis that changes in risk and capital do not influence each other, the coefficients λ_2, λ_3 and θ_3 will not be significantly different from zero. As mentioned earlier, in order to check the robustness of the results, we also estimate the model using the two-stage least squares (2SLS) procedure.

Empirical relationships of (7) and (8) requires measures of both bank capital and portfolio risk. Data on capital adequacy for the period under study has been culled out from the *Report on Trend and Progress of Banking in India*. Bank-wise data on asset items has been culled from the *Statistical Tables Relating to Banks in India*. The asset category is multiplied by the corresponding risk weight to arrive at the risk-weighted measure.

Section VI

Empirical Estimation and Results

The study examined 27 public sector banks (PSBs) for the period 1995-96 to 2000-01, which accounted for about 80-85 per cent of the total assets of the Indian banking system. Changes in capital and risk are measured on a yearly basis, which represents the highest periodicity for which data is systematically available. Table 2 shows bank characteristics, including changes in risk, capital and non-performing assets for banks. For instance, as on March 31, 1996, the average level of capital of the PSBs was 7.573 per cent with corresponding risk-weighted asset ratio of 42.681 per cent. Over the period, the average level of capital has witnessed a rise with the aforesaid ratio being 10.53 per cent in 2001 and the risk-weighted asset ratio recording an increase to 44.44 per cent. Likewise, the average level of non-performing assets of PSBs has witnessed a steady decline from 18.12 per cent as at end-March 1996 to 12.73 per cent, as at end-March 2001.

Table 2: Means of Variables, by year (End-March)

Year	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**
CAP	7.573	9.214	11.129	10.349	10.565	10.533
NON	18.118	18.529	17.046	16.349	14.196	12.734
RISK	42.681	42.815	42.446	44.499	44.911	44.436
ΔCAP	0.137	1.642	1.915	-0.780	0.216	-0.032
ΔNON	-0.966	0.410	-1.482	-0.697	-2.152	-1.462
ΔRISK	-0.425	0.133	-0.369	2.053	0.411	-0.475
LNSIZE	9.420	9.523	9.676	9.842	9.998	10.133
RoA	-0.429	0.467	0.711	0.434	0.543	0.495

Table 3 presents the simple correlation among all non-categorical variables, including relevant first differences. Correlations are based on the pooled sample (six observations on 27 banks). As suggested in the table, cross-sectional positive correlation (0.144) between levels of CAP and RISK is indicated in table 2, whereas the correlation in first differences is negative (-0.160). This underscores the importance of specifying the dynamics of bank behaviour relative to risk and capital in terms of first differences, rather than levels.

Table 3: Correlations Among the Variables

Variable	NON_{t-1}	$RISK_{t-1}$	ΔCAP_t	ΔNON_t	$\Delta RISK_t$	LNSIZE
CAP_{t-1}	-0.646	0.144	-0.347	0.119	0.172	0.101
NON_{t-1}		-0.413	0.042	-0.249	-0.057	-0.024
$RISK_{t-1}$			-0.047	0.253	-0.289	0.276
ΔCAP_t				-0.249	-0.160	-0.127
ΔNON_t					-0.138	-0.088
$\Delta RISK_t$						0.109

The results for SUR estimation for the entire sample are given in Table 4 (panels A and B). All the variables which were included for their potential impact on target capital and risk levels were statistically significant in one of the two equations. Bank size (LNSIZE) had a negative impact on target capital levels, indicating a relatively lower increase in the ratio of capital to risk-weighted assets for large banks *vis-à-vis* smaller ones. For banks overall, size was negatively related to the composite risk index. This result might reflect differences in the markets served by larger *vis-à-vis* smaller banks, which in turn affect their product mix, such that banks have a smaller fraction of assets in categories with lower risk weights (such as loans and advances). The parameter estimate on the lagged capital ratio was quite high, thereby implying fairly rapid adjustment of capital ratios to the bank's desired levels. The return on asset (RoA) variable was positive and statistically significant; the result was to be expected, because in equilibrium, riskier banks should have a higher expected income (and thereby profits), and to the extent that higher returns are realised, they would tend to have larger changes in capital[14]. Finally, the results of Table 4 suggest that changes in capital and risk are negatively related. The results are not surprising because an undercapitalised banks can meet the risk-based requirement by raising capital, reducing portfolio risk, or both, while a bank with a ratio above the risk-based minimum may decrease capital or increase risk.

Table 4: SUR Estimates of the Two-Equation Model

Panel A: Dependent Variable =ΔCAP_t

Variable	Parameter Estimate	t-Statistic
Intercept	9.262*	4.34
LNSIZE	-0.251	-1.14
REG	-7.169*	-7.44
CAP_{t-1}	-0.668*	-9.79
CAP_{t-1}*REG	0.209*	2.28
ΔNON_t	-0.041	-0.61
$\Delta RISK_t$	-0.263*	-5.64
RoA	1.576*	6.78
Number of Banks 27 No. of observations 162 Adjusted R-square 0.53		

* significant at 1%

In Table 4, potential effects of having total capital below the level deemed adequate by regulators (*i.e.*, 8 per cent upto March 1999 and 9 per cent, effective April 2000) are accounted for as an intercept effect (REG) in each of the two equation estimated. Additionally, the interactive term (CAP_{t-1} *x* REG) in the capital equation allows the rate of adjustment of the capital level to vary according to the regulatory classification.

Table 4: SUR Estimates of the Two-Equation Model

Panel B: Dependent Variable =$\Delta RISK_t$

Variable	Parameter Estimate	t-Statistic
Intercept	2.220	0.65
LNSIZE	0.619***	1.72
REG	-4.077*	-3.86
$RISK_{t-1}$	-0.176*	-4.27
ΔCAP_t	-0.377*	-4.53
ΔNON_t	-0.115	-1.06
Number of Banks 27 No. of observations 162 Adjusted R-square 0.59		

* significant at 1%; *** significant at 10%

The coefficient on REG in panel A equals –7.169, which indicates a negative impact on target capital level; the same is also borne out by the negative sign on the REG coefficient in panel B. Additionally, the coefficient on the interaction term in panel A is positive, and significant at conventional levels. This might be a pointer to the fact that regulatory pressure induces banks to increase their speed of adjustment of target capital levels.

In order to test the robustness of the results, we also estimate the same model by two-stage least squares (2SLS). The results of the analysis are materially similar in both the capital and risk equations (Table 5: panels A and B). Specifically, in the capital equation, the magnitudes of the coefficients are roughly of the same order as in the case of the SUR estimates. Illustratively, in the capital equation, current earning (RoA) has a significant and positive impact on capital, indicating that profitable banks can more easily improve their capitalisation through retained earnings. LNSIZE has a negative and significant impact on capital, suggesting that large banks increased their ratio of capital to risk-weighted assets less than other banks. Regulatory pressure has a negative and significant impact on the ratio of capital to risk-weighted assets. *Ceteris paribus*, adequately capitalised banks decrease their capital ratio more prominently than other banks.

In the risk equation likewise, the regulatory pressure variable has a significant impact on banks' risk, indicating that banks approaching the minimum capital requirements decreased the share of risk-weighted assets in their portfolio. LNSIZE has a positive impact on risk, reflecting big banks disengagement from relatively risk-free assets towards relatively riskier asset categories. In both Tables (5A and 5B), there seems to be a significant negative relationship between changes in capital and changes in risk, confirming the fact that increases in capital ratios are accompanied by decreases in the ratio of risk-weighted assets to total assets.

Table 5: 2SLS Estimates of the Two-Equation Model

Panel A: Dependent Variable =ΔCAP_t

Variable	Parameter Estimate	t-Statistic
Intercept	10.235*	4.54
LNSIZE	-0.321	-1.40
REG	-6.999*	-7.06
CAP_{t-1}	-0.701*	-9.76
CAP_{t-1}*REG	0.213*	2.24
ΔNON_t	0.001	0.01
$\Delta RISK_t$	-0.059	-0.46
RoA	1.600*	6.53
Number of Banks 27 No. of observations 162 Adjusted R-square 0.594		

* significant at 1%

Table 4: 2SLS Estimates of the Two-Equation Model

Panel B: Dependent Variable =$\Delta RISK_t$

Variable	Parameter Estimate	t-Statistic
Intercept	0.322	0.09
LNSIZE	0.862**	2.33
REG	-3.024*	-2.71
$RISK_{t-1}$	-0.189*	-4.50
ΔCAP_t	-0.092	-0.78
ΔNON_t	-0.024	-0.21
Number of Banks 27 No. of observations 162 Adjusted R-square 0.14		

* significant at 1%; ** significant at 5%

Section VII

Concluding Remarks

The study utilises several periods of cross-section data on commercial banks in a simultaneous equation framework to estimate the effect of changes in risk on changes in capital, and changes in capital upon changes in risk. The sample encompasses 27 public sector banks operating in India over the period 1995-96 through 2000-01. Important regularities in the data are interpreted in the light of the existing studies on bank behaviour.

Empirical findings establish a negative and significant impact of size on capital, indicating that large banks increased their ratio of capital to risk weighted assets less than other banks. Regulatory pressure is also found to have a negative and significant impact on the ratio of capital to risk-weighted assets. *Ceteris paribus*, adequately capitalised banks decrease their capital ratio more prominently than other banks.

The results establish that risk exposure and capital levels are simultaneously related, and that the majority of banks mitigate the effects of increases in capital by decreasing asset risk posture, and *vice versa*. The results, however, do not necessarily imply that levels of bank capital are adequate from a public policy perspective.

Notes

[1] Evidence presented by Jackson *et al.* (1999) from the FitchIBCA database as well as the Basel Committee shows that the industry average capital ratio of banks increased from 9.3 per cent in 1988 to 11.2 per cent in 1996.

[2] The New Consultative Paper, put forth by the Basel Committee in June 1999 attempts to address the several shortcomings associated with the old Accord. The Accord rests on three pillars of *minimum capital requirements*, *supervisory review of capital adequacy* and *market discipline*. Under the first pillar, the Committee has proposed to build on the extant minimum capital requirements' by announcing explicit risk weighting structure for different activities and explicit risk weights for other categories of risks such as market risks and operational risks (Basel Committee on Banking Supervision, June 1999).

[3] Their estimates suggest that under-capitalised banks raise their capital ratios by 200 and 800 basis points per annum (depending on the year and the capital ratio in question) more than do well-capitalised banks. All these estimates are significant at the 5 per cent level.

[4] The number has since been reduced to 19, with the merger of two public sector banks in 1993.

[5] As at end-December 2001, the cash reserve ratio was 5.5 per cent (statutory minimum of 3 per cent) and the statutory liquidity ratio was 25 per cent (the legal minimum). The corresponding figures as at end-March 1994 were 14.0 per cent and 34.25 per cent, respectively.

[6] The number has since been revised upwards to 12 per cent in 1996.

[7] The State Bank of India (SBI) was fully owned by the RBI and the 7 associates of SBI were fully owned by SBI itself.

[8] Defined as assets of top 5 public sector banks to total assets of the 27 public sector banks.

[9] The five largest banks (in terms of asset) till 2000-01 were in the state domain.

[10] In line with the specificities of the Indian situation, the risk weights on several on- and off-balance sheet items were adjusted to reflect market realities.

[11] Nachane *et al.,* 2001.

[12] The passage of the Securitisation Bill in the Parliament in 2002 is expected to provide necessary impetus to bankers to ensure sustained recovery.

[13] The figure is 9 per cent for the years 1999-2000 and 2000-01, since banks had to comply with a minimum CRAR of 9 per cent, effective March 31, 2000.

[14] It is of significance to note that Indian public sector banks recorded much lower growth in provisioning as compared to the private banks. As a result, during the period under study, public sector banks were able to increase profit and thus capital by not managing the prospective risk via provisioning. The relationship between RoA and change in capital should thus be treated accordingly.

References

Aggarwal, R and K.Jacques (1998), A Simultaneous Equations Estimation of the Impact of Prompt Corrective Action on Bank Capital and Risk, in *Financial Services at the Crossroads: Capital Regulation in the 21 st Century*, Federal Reserve Bank of New York, Conference Volume.

Ediz, S., I.Michael and W.Perraudin (1998), 'Bank Capital Dynamics and Regulatory Policy', in *Financial Services at the Crossroads: Capital Regulation in the 21 st Century*, Federal Reserve Bank of New York, Conference Volume.

Jackson, P. C.Furfine, H.Groeneveld, D.Hancock, D.Jones, W.Perraudin, L.Radecki and M.Yoneyama (1999), *Capital Requirements and Bank Behaviour: The Impact of the Basle Accord*, Basle Committee on Banking Supervision, WP 1, Basel: Switzerland.

Jacques, K and Nigro, P (1997), 'Risk-based Capital, Portfolio Risk and Bank Capital: A Simultaneous Equations Approach', *Journal of Economics and Business*, 49, 533-548.

Lindgren, C.J., G.Garcia and M.Saal (1996), *Bank Soundness and Macroeconomic Policy*, IMF: Washington.

Nachane, D.M., Aditya Narain, Saibal Ghosh and S.Sahoo (2001), 'Regulating Market Risks in Banks: A Comparison of Alternative Regulatory Regimes', *ICRA Bulletin: Money and Finance*, August.

Nachane, D.M. and Saibal Ghosh (2001), 'Risk-based Standards, Portfolio Risk and Bank Capital: An Econometric Study', *Economic and Political Weekly*, March.

Reserve Bank of India, *Statistical Tables Relating to Banks in India* (various years).

Reserve Bank of India, *Report on Trend and Progress of Banking in India* (various years).

Rime, B (2001), 'Capital Requirements and Bank Behaviour: Empirical Evidence for Switzerland', *Journal of Banking and Finance*, 25, 789-805.

Shrieves, R and D.Dahl (1992), 'The Relationship between Risk and Capital in Commercial Banks', *Journal of Banking and Finance*, 16, 439-457.

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The Effectiveness of Intervention in India: An Empirical Assessment

Sitikantha Pattanaik and Satyananda Sahoo*

The empirical assessment conducted in this paper suggests that intervention operations of the Reserve Bank have been effective in containing exchange rate volatility of the Rupee, even though the degree of influence does not appear to be very strong. Estimated results also indicate that intervention operations may not be very effective in influencing the exchange rate levels. India's stated exchange rate policy fully recognises these aspects and as a result, intervention operations are not used either for driving the exchange rate to any particular level or for keeping the exchange rate contained within any pre-decided range of volatility. Such an intervention strategy reflects the commitment to a market determined exchange rate regime where the Central Bank normally does not interfere with the market dynamics as long as the range of factors that influence the level and volatility of the exchange rate do not give rise to disorderly conditions in the market.

JEL Classification: C2, C3, F31

Key words: Intervention effectiveness, Volatility, Exchange rate

Introduction

The objective of this paper is to assess empirically the effectiveness of intervention operations in the foreign exchange market in India by drawing on the methodologies commonly applied in the empirical literature on the subject. In undertaking such a study, the unavoidable challenge that one encounters is the inability to construct the right counterfactuals, *i.e*., what could have happened to the exchange rate, both in terms of its level and volatility, in the absence of intervention. The second major difficulty arises from interpreting the objective of countering disorderly market conditions, "a goal that eludes a simple, precise or even impartial definition" (Humpage, 1996). Some even question the rationale behind interventions in an efficient market condition on the ground that fundamental changes are better anticipated and priced by the market, and unless a Central Bank retains some information superiority

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that allows it to interpret fundamentals differently from the market, it must explain transparently why it intervenes to enhance the effectiveness. The very fact that most Central Banks operating with managed flexible regimes have shifted their stated exchange rate goal from "ensuring exchange rate consistent with the fundamentals" to "ensuring orderly conditions in the market" also lends credence to this argument. Another charge that is generally levelled against empirical studies on the effectiveness of intervention is that they fail to recognise the presence of a dynamic game between the Central Bank and the market players, that requires close and constant monitoring of the activities of market players - rather than fundamentals - for conducting intervention. According to Neely (1997), more than 90 per cent of the dealers use some form of technical analysis (involving identification of trends and reversal of trends, local maxima and minima, *etc*. through charting or mechanical trading rules such as the "filter rule", "trading range break rule" or "moving average" and "oscillators" class rules) and over short horizons, technical analysis clearly predominates fundamental analysis. No empirical analysis, therefore, can truly assess the effectiveness of any Central Bank intervention. Recognising these limitations, this paper only presents an assessment of the effectiveness of intervention operations in India by using the standard techniques employed in the empirical literature on the subject.

India's exchange rate regime since March 1993 can be characterised as "managed floating with no fixed target" (Jalan, 2000). Using measures of Exchange Market Pressure (EMP) and Index of Intervention Activity (IIA), Patra and Pattanaik (1998) had viewed the exchange rate of the Indian Rupee to be largely managed, though market determined. In a managed flexible regime, particularly when the barriers to cross-border trade and finance are less pervasive and are expected to be liberalised further as a part of the overall reform process, the usual instruments of policy for ensuring orderly market conditions could comprise: (i) direct foreign exchange market interventions, (ii) monetary interventions, generally taking the form of high interest rates, and (iii) use of administrative measures, including capital controls as "last resort". Pattanaik and Mitra (2001) studied the effectiveness of monetary interventions in relieving the pressure on the exchange rate of the

rupee during major episodes of disorderly corrections of the exchange rate in the post-March 1993 period and concluded that the interest rate defence of the exchange rate was effective in India.

In this paper, the emphasis is laid entirely on examining the effectiveness of interventions, even though it is difficult to disentangle the effect of direct intervention on the exchange rate from those of the monetary and other administrative measures, particularly when all three are used during occasional phases of significant pressures on the exchange rate. With this broad objective, Section I presents a brief account of the important features of the present day exchange rate regime in India. Important considerations that often determine the effectiveness of intervention are encapsulated in Section II. In view of the large volume of empirical literature that exists on the subject of effectiveness of intervention and given the fact that the experience with regard to the efficacy of and the force behind direct foreign exchange market interventions in "effectively leaning against the wind" has been quite mixed, a detailed review of the empirical literature has been avoided by presenting only important findings of these studies in Annexure I. Section III sets out the methodologies commonly applied in the empirical literature to study the effectiveness of intervention. Applying some of these methodologies, Section IV offers an assessment of the effectiveness of the intervention operations in stabilising the exchange rate of the Indian rupee. Concluding observations are set out in Section V.

Section I

Features of the Indian Exchange Rate Regime

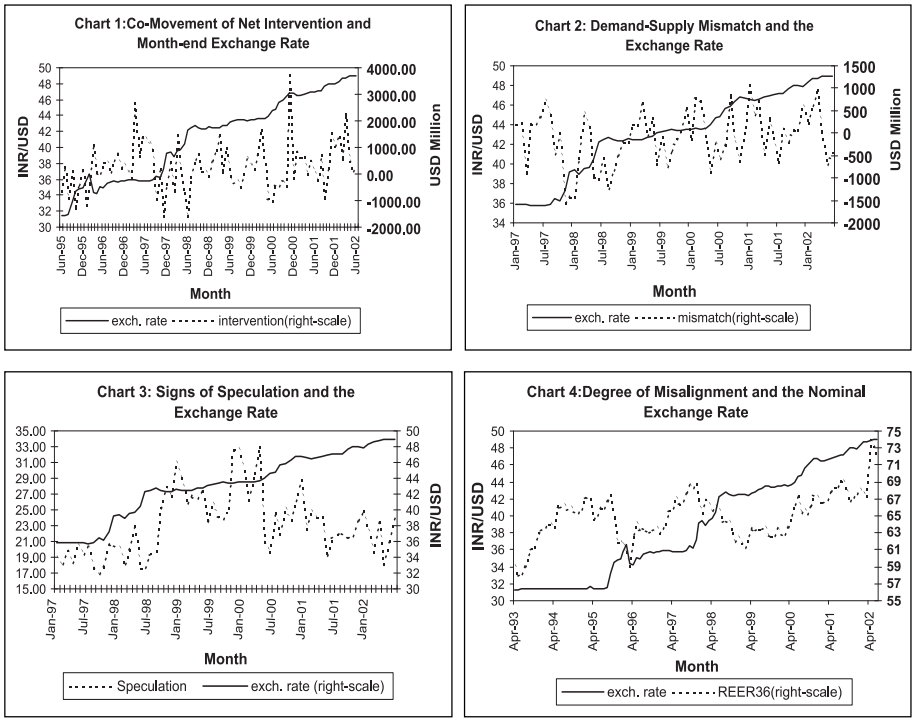
Since March 1993, India has been operating with a managed flexible regime, where the management objective is not to achieve any explicit or implicit target for the exchange rate but to contain volatility by ensuring orderly market conditions. The regime could be interpreted as "more flexible" during normal market conditions with the accent shifting to "management" when the market turns disorderly. While in case of the former, intervention could be viewed as "passive", in case of the latter, intervention is "active". In other words, the objective behind passive intervention could be to "avoid

a nominal appreciation" whereas in case of active intervention, the objective is to "avoid disruptive market corrections". Furthermore, during phases of active intervention, a combination of "leaning with the wind" and "leaning against the wind" may be applied, depending on the perceptions about the extent of accumulated misalignment at the beginning of any episode of exchange market pressure. The policy of leaning with the wind may apply when the correction for the perceived misalignment is ensured by the market forces in an orderly manner. On the other hand, when the market correction turns disorderly – as reflected in heightened volatility – or when the market gets driven primarily by destabilising speculation, pursuing a policy of leaning against the wind becomes inevitable. Though interpretation of misalignment by the market and the authorities at times could vary, both the market and the authorities seem to have referred to the real effective exchange rate (REER) in identifying misalignment over the medium to long-run (Pattanaik, 1999). According to Jalan (2000), "…From a competitive point of view and also in the medium-term perspective, it is the REER which should be monitored….in the short-run, there is no option but to monitor the nominal rate." One unique feature of the Indian regime is that despite attracting net capital inflows of about US $ 89 billion during 1992-2001, and the resultant reserve accretion by about US $ 54 billion (excluding valuation effects) after meeting the financing gap in the current account of about US $ 35 billion, the nominal exchange rate depreciated from Rs. 24.47 per US dollar at the beginning of 1992 to Rs. 48.74 by March 2002. The misalignment arising on account of the positive inflation differential was thus largely corrected by nominal depreciation, despite significant surplus conditions in the market which, left to market forces, could have ensured a large nominal appreciation and the associated significant real misalignment. Nominal appreciation, if allowed, could have, of course, triggered its own corrective mechanism, but that would have represented a different regime altogether whose advantages and disadvantages may be difficult to compare with the present regime due to the typical problem involved in constructing counterfactuals involving exchange rates.

Passive intervention operations in India, thus, not only prevented large accumulation of misalignment but also enabled significant

build up of foreign exchange reserves. In emerging market economies, irrespective of their exchange rate regimes, maintaining a comfortable reserve level has generally emerged as an integral element of the policy for external management in the recent years. The monetary management problems associated with such capital inflows induced reserve build up often create additional complications while operating with a managed flexible regime (Pattanaik, 1997). Even when the objectives assigned to monetary policy, exchange rate policy, and official reserve policy could be different, the direct implications of one for the other suggest the need for a coordinated approach. The exchange rate regime, thus, has implications for the monetary regime.

Unlike passive intervention, active intervention operations have enabled the authorities to absorb the shock to the foreign exchange market arising from temporary supply demand mismatches, particularly the leads and lags, and also helped in containing destabilising speculation which often fuels and feeds on volatility. The co-movement of active intervention and the exchange rate of the rupee – particularly of the turning points and local peaks – is depicted in Chart 1. The impact of any supply demand mismatch in the underlying market - as proxied by the difference between merchant purchase and sales turnover - on the exchange rate is shown in Chart 2. The relationship between speculative positions and disorderly exchange market conditions is graphically presented in Chart 3. Inter-bank to merchant turnover ratio is used as a proxy for speculative position because, given the over-night position limits and absence of any limits on intra-day positions, speculative inter-bank intra-day positions (or day trading) can raise the inter-bank turnover in relation to the underlying merchant turnover. Whether nominal exchange rate behaviour during episodes of significant exchange market pressures reflects corrections for accumulated real appreciation in the previous period can be inferred from Chart 4. The extent of monthly real appreciation depicted in Chart 4 relates to the deviation of the 36-country trade based REER from the level prevailing in March 1993 (following the approach used in the Annual Report of the Reserve Bank of India for 1996-97).



In assessing the appropriateness of an exchange rate regime in the context of the well known impossible trinity, it is often argued that the *first best* policy option could be one where countries with independent monetary policy and open capital account embrace a flexible exchange rate system. For the developing countries, however, pursuance of the *first best* approach generally involves two unavoidable costs: First, in the face of surges in capital flows flexible regimes would give rise to nominal appreciations; riding over the positive inflation differentials the real appreciation could be substantial, eroding thereby the country's external competitiveness. External sector sustainability of a developing economy is highly dependent on the export performance and hence, an exchange rate policy that could threaten the external viability may not be in the interest of such economies. Second, due to lack of market efficiency and thinness of markets, flexible regime may entail unduly large volatility. In such markets agents fail to distinguish between "news" and "noise" and do not price information efficiently. Due to market thinness, some dominant players could even move the market one

way. With no restrictions on capital transactions, speculators could potentially take positions in excess of a country's foreign exchange reserves and thereby influence the market at their whim.

The general policy preference, therefore, has been in favour of the *second best* approaches. Retention of capital controls during the phase of gradual transition to the *first best* represents one variant of the *second best* approach. Countries like India which pursue this variant of the *second best* approach, emphasise orderly liberalisation of capital transactions and regulation of capital flows consistent with the financing needs and absorptive capacities of the economy for reducing vulnerability to exchange rate crises. According to this approach, judicious controls are akin to dams which "do not stop, but only temper the flow of water from the top of a mountain… without the dams there are floods that bring with them death and property destruction. By contrast, with the dam, not only is the death and destruction reduced, but the water itself can be channelled into more constructive uses" (Stiglitz, 1999).

Section II

Factors Influencing the Effectiveness of Interventions

In the theoretical literature on the subject of intervention effectiveness, one comes across a host of arguments explaining why intervention in general turns ineffective. The simplest of such arguments are that: (i) If exchange rate is primarily decided by the demand and supply positions in the foreign exchange market, only a large volume of intervention relative to the turnover in the foreign exchange market can make an intervention successful. But, the amount used by the Central Banks to intervene generally represents only a small proportion of both daily market turnovers and demand-supply mismatch; (ii) If the exchange rate is interpreted as the relative price (value) of national money (at least in the medium to long-run – as per the monetary approach to exchange rate), non-sterilised interventions can always change the supply of money in relation to demand in one country and thereby influence the exchange rate. But again, the change in the stock of money resulting from intervention may not be very significant. Moreover, intervention

operations in general are sterilised – to ensure that intervention operations remain money supply neutral - and hence, the non-sterilised channel of intervention is not very important empirically; and (iii) If the exchange rate is viewed as the relative price of financial assets denominated in different national currencies (*i.e.*, the asset market approach to exchange rate determination), sterilised interventions could affect the exchange rate by altering the supply of domestic bonds *vis-a-vis* bonds denominated in foreign exchange. In relation to the large stock of publicly traded domestic and foreign bonds, the change in the demand-supply position caused by sterilised intervention operations may, however, be very marginal.

An assessment of intervention effectiveness, thus, involves clear identification of the transmission channels. From the stand point of a Central Bank, both sterilised and non-sterilised intervention channels are important because while the former has implications for the interest rate scenario, the latter can influence the monetary base and hence, the aggregate money stock. Non-sterilised and sterilised interventions essentially rely on the monetary channel and the portfolio balance channel, respectively. Non-sterilised intervention purchases (sales) give rise to higher (lower) money stock, which in turn lead to exchange rate depreciation (appreciation) as per the monetary approach to exchange rate. As per this approach, any money stock mismatch resulting from non-sterilised interventions may get reflected in change in the exchange rate, both under flex-price and sticky-price conditions. The argument against the use of non-sterlised intervention is that it is akin to open market operations (with the only difference that foreign, rather than domestic assets are exchanged). In essence, therefore, it is more like a monetary policy instrument rather than an instrument for attaining the exchange rate objective. Moreover, non-sterlised intervention generally operates as a constraint to independent conduct of monetary policy whereas sterilisation helps in regaining monetary policy independence. Not many Central Banks may even tolerate large variability in short-term money market rates resulting from non-sterilised intervention, particularly in view of the fact that short-term interest rate is being increasingly relied upon by them as the primary operating instrument of monetary policy.

Sterilised interventions, which are money supply neutral, do not influence the exchange rate through monetary disequilibrium. Instead, by altering the relative supply of domestic and foreign bonds, such interventions engineer a portfolio reallocation in the market in response to the divergence of the rates of return on domestic and foreign assets. The assumption of perfect asset substitutability that underlies the monetary approach has to be relaxed in the portfolio balance channel for sterilised intervention to work. If assets are assumed to be perfect substitutes, agents would not be concerned about the relative supplies of assets since their primary concern will be only the total size of the portfolio. Agents will be insensitive to transactions involving exchange of foreign bonds for domestic bonds resulting from sterilised intervention operations undertaken by a Central Bank. In turn, if assets are assumed to be imperfect substitutes, agents would continuously reallocate their portfolios among domestic and foreign bonds based on expected return changes resulting form intervention induced changes in relative supplies of domestic bonds. Under sterilised intervention, the crucial variable that one has to examine is the excess return or risk premium that domestic bonds must offer in order to induce the agents to willingly hold the altered (higher/ lower volume of) domestic bonds. The risk premium (RP) can be approximated by ($RP = r - r^* - e^e$), where r and r* represent nominal returns on domestic and foreign bonds, respectively and e^e is the expected change (appreciation/depreciation) of the exchange rate. Condition of uncovered interest rate parity (UIP) would suggest that a currency fetching higher (lower) interest rate must necessarily depreciate (appreciate) to equalise return on assets denominated in different currencies. Presence of risk premium, however, may complicate the empirical assessment of UIP. Empirical tests of the existence/absence of risk premium actually examine a joint (null) hypothesis of “no risk premium” and “foreign exchange market efficiency”. Rejection of the null, therefore, does not explain whether the foreign exchange market is inefficient or whether there is evidence of the presence of risk premium. Acceptance of the joint null, in any case, cannot validate the presence of portfolio balance channel. Given the difficulty in inferring results from the joint hypothesis, how could one explain the portfolio balance channel? One option could be to explore alternative effects of sterilisation by rewriting

the risk premium (RP) equation as:

$$RP = r - r^* - [(E^e - E)/E]$$

where $e^e = [(E^e - E)/E]$, E and E^e represent levels of spot and expected exchange rates (domestic currency units per unit of foreign currency), respectively.

Any increase in the supply of domestic bonds resulting from sterilised intervention purchases would increase the risk premium; *i.e.,* only by offering higher return agents can be induced to willingly hold the higher supply of domestic bonds. In practice, this increase in risk premium would get reflected either in: (i) an increase in r, or (ii) a decline in r*, or (iii) a decline in E^e , or (iv) an increase in E, or (v) a combination of all four. r* is least likely to be affected by sterilised intervention operations undertaken by any emerging market economy. Regarding the effect on r, there could be two views. One view is that sterilised interventions do not alter the monetary base and, therefore, r should remain unaffected. Another view, which relies on the values of offset coefficients to explain how sterilisation does not solve the monetary management problem arising from surges in capital flows, suggests that only by offering higher interest rates a Central Bank can sell more domestic bonds in exchange of the foreign exchange purchased by them to mop up the capital flows induced surplus in the foreign exchange market. If interest rates remain unchanged and expected exchange rate level also remains unchanged, the only possible outcome resulting from sterilised purchase (sale) of foreign exchange could be depreciation (appreciation) of the domestic currency. One may argue that during surges in capital flows the objective behind sterilised intervention would be to prevent a nominal appreciation, rather than to ensure a depreciation following the portfolio balance channel. It is difficult to offer any valid counter argument because of the problem of empirical testing of the joint hypothesis already mentioned above as also the lack of success in establishing strong empirical relationship between time varying risk premia and the relative changes in asset supplies brought about by sterilised interventions.

In view of the growing recognition that “direct” effects of intervention on exchange rates are either statistically insignificant

or quantitatively unimportant, greater emphasis has been laid on "indirect" channels, which operate by altering market expectations and triggering forced position shifts. In terms of this approach: (i) intervention can be used as a signaling device – *i.e.*, to signal a Central Banks monetary policy intentions. To establish the credibility of signals, interventions should be followed up by monetary policy actions; (ii) Intervention can also be used to signal authority's perceptions about a fundamentals justified "fair/right" value of the currency and thereby contribute to anchor market expectations. For this channel to be successful, the Central Bank must have established a track record of superior assessment of fundamentals through its regular publications and other channels of communication with the market participants. Information superiority resulting from non-transparent dissemination of information could also enable the Central Bank to view the fundamentals differently from the market; and (iii) When noise-traders drive the rate far beyond the "fair" value and accumulate large overbought/oversold positions, intervention could be used as a "surprise", forcing the traders to unwind their positions. In the context of the effectiveness of the signaling channel, there is a vast literature on "secret" *versus* "reported" interventions and the related issues of information superiority and time consistent behavior of the Central Banks. A comprehensive review of such studies has been avoided in this paper. Only some important findings of empirical studies are reported in Annexure-I.

Despite the presence of known arguments against the effectiveness of intervention, it continues to be a major instrument for achieving the exchange rate objective, even though the magnitude and frequency of interventions vary widely across countries. In the post Bretton Woods period, even the IMF recognised the role of intervention when it adopted the "Principles for the Guidance of Member's Exchange Rate Policy" on April 29, 1977 with the following provisions:

i) A member shall avoid manipulating exchange rates or the international monetary system in order to prevent effective balance of payments adjustment or to gain an unfair competitive advantage over other members.

ii) A member should intervene in the exchange market if necessary to counter disorderly conditions which may be characterised

inter alia by disruptive short-term movements in the exchange value of its currency.

iii) Members should take into account in their intervention policies the interests of other members, including those of the countries in whose currencies they intervene.

An exact interpretation of "disorderly condition", however, is almost non-existent in the literature. Rosenberg (1996) noted that the interpretations could vary depending on the stated objectives behind intervention, such as:

i) Simple smoothing operations to limit potentially erratic short-run fluctuations in exchange rates;

ii) Operations to counter excessive speculation or market overreaction to changes in economic fundamentals;

iii) Trend-breaking operations to put an end to a persistent uptrend or downtrend in a currency's value;

iv) Operations to counter excessive risk aversion;

v) Exchange rate targeting operations designed to rigidly peg a currency's value to some specific level or range;

vi) Resistance to exchange rate movements that exceed some threshold rate of change;

vii) Intervention only to prevent large and persistent misalignments of exchange rates that might harm long-term international competitiveness; and

viii) Trend-indicating operations to help push a currency's value in a desired direction.

The stated objectives, thus, leave considerable scope for ambiguity. Some ambiguity, however, may be necessary because the sources of exchange rate volatility / misalignment could be too many and the importance of each could vary over time. According to Rosenberg (1996), the disorderly conditions may arise because: (i) the market may not be using all available information efficiently, (ii) the market may be using a defective model to predict the future path of the exchange rates, (iii) although the market may be using the correct model, its perceptions about the future may be seriously flawed, (iv) the market may be placing undue emphasis on extraneous

information that is not quantitatively important in terms of the medium or long-term trend in exchange rates, or (v) the market may be subject to persistent mood swings, constantly shifting from excessive optimism to excessive pessimism. The ambiguity in the stated objective behind intervention, therefore, in a sense recognises the uncertainty about the alternative sources of exchange rate volatility and also helps Central Banks in retaining some element of discretion so that similar market developments need not be followed up with similar reactions. There may, however, be a trade-off between ambiguity and scope for time inconsistent behaviour by the Central Banks. Constructive ambiguity, which is a common feature of the intervention strategies of most Central Banks, essentially reflects a realisation of the great uncertainty against which an intervention operation has to be conducted, and in the absence of information superiority, it largely indicates the intention of a Central Bank rather than its ability to attain the stated objective.

Section III

Methodologies for Empirical Tests

In the empirical literature on the effectiveness of intervention, a number of alternative methodologies have been applied, all of which cannot be tested for India due to non-availability of daily data on intervention. In India, intervention data are available on a monthly basis and, therefore, only such methodologies that can be applied to monthly data are emphasised here. Other methodologies that cannot be applied have only been mentioned to highlight the future scope for empirical research in this area.

One of the early attempts to examine the effectiveness of intervention relied on profitability criterion. Friedman (1953) noted that "there should be a simple criterion of success – whether the agency makes or loses money". Edison (1993) proposed the test of profitability as:

$$\Pi_t = \sum_{i=1}^{t} \left[Intv_i \, (e_t - e_i) + e_t \, (r_t^* - r_t) \sum_{i=1}^{i} Intv_i \right] \qquad (1)$$

where profit (Π_t) is a function of the intervention purchase (or sale) of US dollars at e_i in relation to the end period exchange rate e_t and the interest rate differentials (*i.e.,* the difference in the rate of return on rupee and dollar deposits). According to this methodology, positive Π_t would indicate success of intervention operations. Bank of England also recognised the role of profit when its Quarterly Bulletin for December 1980 reported that " … intervention has been largely confined to smoothing out fluctuations in the rate – for example, selling sterling when it is strong in demand, with the aim of buying it back at a profit quite soon, perhaps even the same day".

The most commonly applied tests, however, use simple regressions in which either levels of exchange rates or their volatility are explained by levels of interventions. As per Almekinder's (1994) regression test:

$$e_t - e_{t-1} = a_0 + a_1 \text{ Interventions}_{(t \text{ to } t-1)} + a_2 (e_{t-1} - e_{t-2}) + u_t \qquad (2)$$

where the coefficient a_1 should be positive for interventions to be effective and a_2 should be positive if there is a "following the trend" pattern in the exchange rate.

The above OLS regression assumes that the direction of causality runs only from intervention to exchange rate even though in reality intervention may have to be undertaken in response to observed behaviour of the exchange rate. Recognising the simultaneity problem, Almekinders and Eijffinger (1994) suggested the following simultaneous equation systems:

$$e_t - e_{t-1} = a_0 + a_1 \text{ Interventions}_{(t \text{ to } t-1)} + a_2 (e_{t-1} - e_{t-2}) + u_t \qquad (3)$$

$$\text{Interventions}_{(t \text{ to } t-1)} = b_0 + b_1 (e_t - e_{t-1}) + b_2 (e_{t-1} - e_{t-2}) + \in_t \qquad (4)$$

where a_1 should be positive and b_1 should be negative.

In the system of equations, the second one is a typical Central Bank reaction function and, therefore, variables representing deviations of actual exchange rate from any explicit/implicit exchange rate

targets can also be included in the regression equation. Several other factors (X_t) influencing both intervention and exchange rate could also be used as additional explanatory variables in the above equations. Following Black (1980), Argy (1982) and Keneray and MacDonald (1986), the reaction function could be estimated as :

$$\text{Intervention}_t = \alpha_0 + \alpha_1 (\%\text{ change in exchange rate})_{(t-1 \text{ to } t)} + \alpha_2 \text{Intervention}_{(t-1)} + \alpha_3 (\text{deviation of current exchange rate from PPP or FEER, the latter two representing targets, if any}) + \alpha_4 (\text{actual volatility in excess of tolerable volatility}) + u_{1t} \quad (5)$$

where $\alpha_0 > 0$ implies a policy of reserve build up through intervention purchases.

As opposed to the tests relying on exchange rate levels, some studies also examine the impact of intervention on volatility. As per the test suggested by Bonser-Neal (1996):

$$\text{Exchange rate volatility} = \beta_0 + \beta_1 \text{Interventions} + \beta_2 (\text{macro-economic indicators}) + u_{2t} \quad (6)$$

where the macro-economic indicators could include deviation of REER from PPP, deviation of actual money growth from target, volatility in equity markets, industrial production and export performance, as well as lagged exchange rate volatility to capture the feedback effects. An intervention coefficient β_1 that is negative and statistically significant suggests that intervention helped in reducing volatility and, therefore, must be stabilising. The simultaneity argument mentioned in case of tests using exchange rate levels also apply in this case.

Besides the above alternative approaches, one also comes across other methodologies like the Fausten's (1995) test of co-integration among the exchange rate, the targeted level of exchange rate (if any, say in relation to REER or FEER based misalignment), and the control variable at the disposal of the authorities (*i.e.*, interest rate and/or intervention purchases/sales).

This paper applies the above methodologies to assess the effectiveness of intervention operations in India. Other methodologies which can be tested using daily (or even higher frequency) intervention data include: Engle's ARCH and Bollerslev's GARCH models to forecast volatility - both in sample and out of sample - so as to assess whether interventions can be effected in a forward looking manner, Bonser-Neal and Tanner (1996) type GARCH estimates of conditional volatility using implied volatility from currency option markets as proxy for ex-ante volatility, and Galati and Melick (1999) type Logit / Probit models. Due to non-availability of data, this paper does not attempt to apply these techniques for assessing the intervention effectiveness in India.

Section IV

An Empirical Assessment of Intervention Effectiveness in India

In India, monthly data on intervention operations in the spot market are available from June 1995. In applying the Friedman's test of profitability to assess the effectiveness of intervention, however, one must recognise that in the absence of information on transaction-wise details of intervention purchases and sales it is almost impossible to arrive at the true profit/loss figure associated with a Central Bank's intervention operation. We, therefore, follow the approach adopted by Pilbeam (1991) to approximate the profit figure (Π_t) as per the following equation by separately estimating the exchange rate related profit/loss and the interest rate related profit/loss.

$$\Pi_t = \sum_{i=1}^{t} \left[\text{Intv}_i \ (e_t - e_i) + e_t (r_t^* - r_t) \sum_{i=1}^{i} \text{Intv}_i \right] \qquad (7)$$

Here the assumption is that, if the Central Bank can purchase foreign currency at an appreciated rate and sell at a depreciated rate, it can make profits (*i.e.*, the principle of buy low and sell high). While acquiring foreign currencies through intervention purchase, however, a Central Bank may have to also compare the returns on

domestic and foreign assets. If the domestic interest rate scenario can fetch a higher return on domestic assets than foreign assets, by accumulating reserves through intervention purchases it may incur some interest rate related loss, with the magnitude of loss depending on the extent of interest rate differential prevailing at any point of time. The steps to calculate the respective gains/ losses are set out below:

i) Convert the monthly US dollar intervention purchases/sales at the monthly average exchange rate into rupees.

ii) Convert the cumulative US dollar intervention at the end period exchange rate into rupees.

iii) Calculate the exchange rate related gain/ loss at any point of time as the difference between (b) and (a).

iv) For arriving at the interest rate related gains/losses, first estimate the monthly average cumulative intervention balances for every month. A simple approximation could be the average cumulative balance of two consecutive months.

v) Apply the interest rate differential (annual interest rates converted into monthly rates) to the monthly cumulative balance.

vi) Convert the cumulative interest gain/loss expressed in US dollars over months by the end of a particular period at the end period exchange rate into rupees.

vii) Combine the exchange related gains/losses and the interest rate related gains/losses to arrive at the total profit/loss figure associated with intervention.

In adopting this approach, as suggested by Edison (1993) and Pilbeam (1991), one cannot avoid the following unrealistic assumptions: (i) all interventions are made in US dollar, (ii) interventions are spread out evenly throughout the month, (iii) profits and losses on intra-month trading are ignored, (iv) all interest rate gains/losses are converted at the end of the period into rupees, and (v) net cumulative intervention can be closed at the end of any period at the end-period exchange rate without altering the exchange rate. These unrealistic assumptions suggest that any attempt to estimate the intervention related profits would only be fraught with errors.

However, such estimates can provide some broad indication over a period of time, if not at any particular point of time, about the profitability pattern. Keeping this in view, the estimated gains/ loses associated with interventions operations in India over a span of more than seven years are presented in Table 1.

Table 1: The Profitability of Intervention Operations in India

Year	Cumulative Interventions [In US dollar Million]*	Exchange rate related cumulative profits(+)/loss(-) [In Rupees Million]	Interest rate related** cumulative Profits(+)/loss(-) [In Rupees Million]	Total cumulative Profits (+)/loss(-) [In Rupees Million]
1996-97	7,447	4,251.1	- 4,287.4	-36.3
1997-98	11,316	44,453.3	- 28,987.2	15,466.1
1998-99	13,158	76,199.1	- 55,333.1	20,866.0
1999-2000	16,407	92,382.2	- 91,026.8	1,355.3
2000-01	18,763.68	1,36,951.8	- 143,673.6	-6,721.0
2001-02	25,826.70	1,81,245.6	- 178,711.7	2,533.9
2002-03 (April-June)	26,629.95	1,83,127.5	- 185,093.3	-1,965.8

*Cumulative since June 1995.

** Interest rate on 91 day Treasury Bill (TB) in India minus 3 month LIBOR.

As could be seen from Table 1, it is difficult to make an assessment about intervention effectiveness from the estimated end-year profit positions since in different years contrasting positions are obtained for India. As noted by Pilbeam (1991), authorities may make profit when net interventions are close to zero and as the levels of net interventions increase, profitability may decline and over time they may even incur net losses. However, when cumulative interventions are large, they need not reflect only the exchange rate objective, as reserve accumulation policy may at times be guided by a host of factors, including of course the exchange rate objective. In such cases, despite the known opportunity costs of holding high reserves and the associated net loss, reserve accumulation policy may continue in the interest of other objectives to be achieved through a high reserve policy. Furthermore, recognising

the problem of possible large errors that may be associated with estimates of intervention profitability, we turn to other methodologies that are more commonly used in empirical literature.

Applying ordinary least square(OLS) regressions of the type suggested by Almekinder (1994) and Bonser-Neal (1996), we obtain the following results for India.

i) DEPR = 0.28 – 0.0002 INTV
(5.25)* (-3.97)*
$\bar{R}^2$ = 0.15 , DW = 1.92

ii) DEPR = 0.12 – 0.0003 INTV +0.02 MISALIGNMENT
(0.09) (-4.19)* (1.41)
$\bar{R}^2$ = 0.16 , DW = 1.95

iii) DEPR = 0.36 – 0.0002 INTV – 0.02 INTGAP
(5.24)* (-4.15)* (-1.79)***
$\bar{R}^2$ = 0.17 , DW = 1.93

iv) VOLA = 0.17 – 0.0005 INTV
(8.67)* (-4.22)*
$\bar{R}^2$ = 0.17 , DW = 1.49

v) VOLA = 0.12 – 0.0008 INTV + 0.01 INTGAP
(4.48)* (-3.78)* (2.68)**
$\bar{R}^2$ = 0.27, DW = 1.96

*,**,*** significant at 1, 5 and 10 per cent, respectively.

In the above equations, DEPR refers to monthly change in the exchange rate (*i.e.*, difference between two consecutive end-month Rupee/US dollar rate) and VOLA represents volatility of daily exchange rate during a month (*i.e.*, standard deviations of daily rates). INTV is the net monthly intervention. To capture the possible impact of certain fundamental variables on the exchange rate (both in terms of level and volatility), we use INTGAP (*i.e.*, the difference between 91 day Indian tresury bill and 3 month LIBOR) and MISALIGNMENT (*i.e.*, deviation of the REER from its March 1993 level, as explained in Section-I).

First three estimated equations suggest that the intervention coefficients are wrongly signed, implying that intervention operations may not be effective in influencing the exchange rate levels or the extent of change in the exchange rate during a month. The last two equations, however, suggest that intervention operations can be effective in lowering exchange rate volatility. The intervention coefficients in the volatility equations are correctly signed and statistically significant. Thus, given the Reserve Bank's exchange rate objective of ensuring orderly conditions in the market (*i.e.*, to contain volatility and not to achieve any particular level of exchange rate), intervention in India can be viewed as an effective instrument.

All the estimated equations suggest that certain fundamentals like interest rate gaps and degree of misalignment could have some influence on both degree of change in exchange rate as well as volatility. Exchange rate may depreciate more when the misalignment is higher (exhibiting thereby a positive relationship). Similarly, higher interest rate gap would create expectations of a depreciation of domestic exchange rate as per the condition of uncovered interest rate parity (explaining a positive relationship of both volatility and change in exchange rate with interest rate differential). While the respective fundamental variables are correctly signed, in some of the equations they do not turn out to be statistically significant. Since the objective of this paper is to assess the effectiveness of intervention, we do not attempt to study the relevance of fundamentals in great detail.

Recognising the problem of simultaneity highlighted by Almekinders and Eijffinger (1994), we estimated the volatility equation again in a simultaneous framework along with an intervention reaction function of the Central Bank. This framework is more realistic in the sense that volatility not only responds to intervention operations but it also triggers intervention action by the Central Banks. The results of Two-Stage Least Square (TSLS) regressions presented below suggest that volatility often triggers intervention actions but such interventions may not always be effective in reducing volatility.

INTV = 529.3 – 2859.6 VOLA + 17.9 MISALIGNMENT
(1.56) (-2.16)** (0.91)

$\bar{R}^2$ = 0.12, DW = 1.83

VOLA = 0.14 – 0.0001 INTV + 0.25 VOLA(-1)
(1.82)*** (-0.67) (1.23)

$\bar{R}^2$ = 0.22, DW = 2.02

,* significant at 5 and 10 per cent, respectively.

In the Central Bank reaction function, the volatility coefficient is of the expected sign and is also statistically significant. In other words, when volatility increases (*i.e.*, + VOLA), intervention sales will increase (*i.e.*, – INTV). Hence, the negative relationship is obtained. In the volatility equation, the intervention coefficient is of expected sign, though not statistically significant. Hence, estimates generated in the simultaneous framework do not corroborate the findings of simple OLS.

Following the approach suggested by Fausten (1995), an alternative to the results obtained through OLS and TSLS could be conducted by exploring the possible existence of a co-integration between exchange rate levels/volatility and interventions. ADF test statistics reported in Table 2 indicate that all the three relevant variables, *i.e.*, DEPR, VOLA and INTV are of the same order of integration. Johansen trace statistics reported in Table-3 indicate the presence of one co-integrating relationship between VOLA and INTV and two such relationships between DEPR and INTV. The estimated equations as set out below validate the OLS results, implying that intervention operations in India have been effective in containing volatility, if not the exchange rate levels/extent of change in exchange rate during any month.

VOLA = 0.32 – 0.0005 INTV

DEPR = 0.28 – 0.0003 INTV

DEPR = 5.96 – 0.017 INTV

Table 2: Stationarity Test Statistics (June 1995 to June 2002)

	ADF Test Statistics
INTV	-4.18*
VOLA	-2.59***
DEPR	-5.08*

*,*** imply significance at 1 and 10 per cent levels, respectively, for 4 lags.

Table 3 : Johansen Trace Statistics

Between VOLA and INTV

Eigenvalue	Likelihood Ratio	5 Percent Critical Value	1 Percent Critical Value	Hypothesised No. of CE(s)
0.214288	28.39483	19.96	24.60	None **
0.107537	9.101611	9.24	12.97	At most 1

Between DEPR and INTV

Eigenvalue	Likelihood Ratio	5 Percent Critical Value	1 Percent Critical Value	Hypothesised No. of CE(s)
0.303370	46.00819	19.96	24.60	None **
0.192330	17.08809	9.24	12.97	At most 1 **

The Co-integrating vector with a constant and four lags.

It may be noted that almost all the estimated equations for India exhibit better fit in relation to similar other empirical studies conducted elsewhere. In the OLS and TSLS specifications, low values of the $\bar{R}^2$ in fact turn out to be higher than what one finds in other similar empirical studies. Most importantly, a positive constant term in the reaction function equation corroborates the continuous reserve accretion feature that has characterised the intervention operations in India.

SectionV

Concluding Observations

The empirical assessment conducted in this paper suggests that intervention has been quite effective in India as an instrument to achieve the stated exchange rate objective of ensuring an orderly exchange market. There is little evidence in the empirical tests conducted for India that can validate any possibility of intervention influencing the exchange rate levels on a sustained basis. Exchange rate volatility, as measured by the standard deviations of daily exchange rates over months, however, responds to intervention operations in the expected direction, even though the magnitude of the impact appears to be not very strong. The findings of this paper indicate that in the present day managed float regime of India, intervention can serve as a potent instrument of exchange rate management only at the margin, that too only for managing the magnitude of volatility and not to remove volatility completely. In fact, India's stated exchange rate objective already recognises this aspect, as it neither aims at driving the exchange rate to any particular level nor tries to keep the exchange rate contained within any pre-decided range of volatility. Due to the generalised surplus conditions prevailing in the market, passive intervention purchases have dominated the intervention operations in India. Active intervention has been resorted to only during occasional phases of strong exchange market pressures. It is possible, therefore, that the effectiveness of active intervention in lowering volatility may be much less in relation to passive intervention operations conducted during normal conditions. But that need not be viewed as the inability to contain volatility since, first of all, in a market determined regime the exchange rate must necessarily exhibit some volatility, reflecting the market clearing process. Most importantly, if at every sign of greater volatility the Central Bank reacts with aggressive interventions, the expected market correction for any misalignment may never materialise. Any empirical assessment of the effectiveness of intervention, therefore, cannot account for the entire range of factors, whether stated or unstated, that may be guiding the actual intervention strategy of a Central Bank. Empirical exercises can at best provide only some broad indications about the effectiveness of intervention in a country.

Empirical literature reviewed in this paper covering the exchange rates of advanced countries over different time horizons generally suggest that interventions have not been very effective in the past, either in having any lasting impact on the exchange rate or in lowering the exchange rate volatility. Similar empirical studies on emerging markets are, however, very rare. Given that the type of exchange rate regime pursued by a country, the depth and sophistication of the foreign exchange market, and the regulatory controls on the type and volume of foreign exchange transactions can significantly condition the impact of intervention, it may not be appropriate to assess the performance of intervention in an emerging market keeping in view the empirical findings obtained mostly for advanced countries. The findings of this paper for India suggest that intervention can contain volatility. If the Central Bank decides to loose reserves over the intervention cycle, it can even affect the exchange rate levels. Interventions are, however, carried out only to smooth out temporary mismatches as reflected in the fact that reserve losses incurred during disorderly market conditions are recouped during normal conditions. Such an intervention strategy essentially establishes the commitment of the Central Bank to a market determined regime, where it does not interfere with the market dynamics as long as the market forces continue to determine the course of the exchange rate in an orderly manner.

References

Adams, Donald and Dale Henderson (1983), "Definition and Measurement of Exchange Market Intervention", *Staff Studies 126*, Board of Governors of the Federal Reserve System, Washington DC.

Almekinders, G.J. (1995), *Foreign Exchange Intervention: Theory and Evidence*, Elgar Publication.

Almekinders, G.J. and S.C.W. Eijffinger (1994), "The Ineffectiveness of Central Bank Intervention", *Center for Economic Research Discussion Paper No. 94101*, December.

Andrew, Robert and John Broadbent (1994), "Reserve Bank Operations in the Foreign Exchange Market: Effectiveness and Profitability", *Research Discussion Paper No.9406*, Reserve Bank of Australia, November.

Argy, V. (1982), " Exchange Rate Management in Theory and Practice", *Princeton Studies in International Finance,* No.50.

Baillie, R.T. and William P. Osterberg (1997), " Why Do Central Banks Intervene?", *Journal of International Money and Finance*, Vol.16, No.6.

Blundell-Wignall, A and P.R. Masson (1985), "Exchange Rate Dynamics and Intervention Rules", *IMF Staff Papers*, March.

Bonser-Neal, Catherine (1996), " Does Central Bank Intervention Stabilise Foreign Exchange Rates?", *Federal Reserve Bank of Kansas City Economic Review*, First Quarter.

Bonser-Neal, Catherine and Glenn Tanner (1996), "Central Bank Intervention and the Volatility of Foreign Exchange Rates: Evidence from the Options Market", *Journal of International Money and Finance*.

Boothe, Paul, Kevin Clinton, Agathe Cote, and David Longworth (1985), "International Asset Substitutability: Theory and Evidence for Canada", Ottawa, Bank of Canada.

Bossaerts, P. and Hillion P. (1991), " Market Microstructure Effects of Government Intervention in the Foreign Exchange Market", *Review of Financial Studies*, 4, 513-541.

Corrado, C. and Taylor D. (1986), "The Cost of a Central Bank Leaning Against A Random Walk, "*Journal of International Money and Finance*, 5, 303-314.

Cuddington, J.T. (1991), "Comparing the Intensity of Exchange Market Intervention with Frenkel and Aizeman's index of Managed Float", *Journal of International Economics*, 31, 383-386.

Danker, Deborah J, Richard A. Haas, dale W. Henderson, Steven A. Symansky and Ralph W. Tryon (1987), "Small Empirical Models of Exchange Market Intervention: Applications to Germany, Japan and Canada", *Journal of Policy Modeling*, 9, Spring.

Dominguez, Kathryn (1993), "Does Central Bank Intervention Increase the Volatility of Foreign Exchange Rates?", *NBER Working Paper No. 4532*, November.

Dominguez, K. and Frankel, J.A. (1993), "Does Foreign Exchange Intervention Work?", *American Economic Review*, 83, 1356-1369.

Dooley, Michael P.(1982), "An Analysis of Exchange Market Intervention of Industrial and Developing Countries", *IMF Staff Papers*, June.

Dooley, Michael P, Donal J. Mathieson and Liliana Rojas-Suarez (1997), "Capital Mobility and Exchange Market Intervention in Developing Countries", *NBER Working Paper No. 6247*, October.

Eaton, Jonathan and Stephen J Turnovsky (1984), " The Forward Exchange Market, Speculation and Exchange Market Intervention", *NBER Working Paper* No.1138, November.

Edison, Hali J. (1993), "The Effectiveness of Central Bank Intervention: A Survey of the Literature After 1982", *Princeton Special Papers in International Economics No. 18*, July.

Fausten, D. K. (1995), " The Effectiveness of Exchange Rate Intervention in Post-float Australia", *Economica Internationale*, November.

Feldstein, M. (1986), " New Evidence on the Effects of Exchange Rate Intervention", *NBER Working Paper* No. 2052.

Frenkel, M., C. Pierdzioch and G. Stadtman (2001), "The Foreign Exchange Market Interventions of the European Central Bank", *BNL Quarterly Review*, No.218, 249-287.

Friedman, Milton (1953), " The Case for Flexible Exchange Rates", in *Essays in Positive Economics*, Chicago.

Galati, Gabriele and William Melick (1999), " Perceived Central Bank Intervention and Market Expectations: An Empirical Study of the Yen/Dollar Exchange Rate, 1993-96", *BIS Working Papers, No.77*, October.

Ghosh, A. (1992), "Is it signalling ? Exchange Intervention and Dollar DM Rate", *Journal of International Economics*, 32, 201-220.

Goodhart, C.A.E. and T. Hesse (1993), "Central Bank Foreign Exchange Intervention Assessed in Continuous Time", *Journal of International Money and Finance*, Vol.12, No.4, August, 368-89.

Hsieh, D.A. (1989a), "The Statistical Properties of Daily Exchange Rates", *Journal of International Economics*, 24, 129-145.

Hsieh, D.A. (1989b), "Modeling Heteroscedasticity in Daily Foreign Exchange Rates", *Journal of Business and Economic Statistics*, 7, 307-317.

Huang, Juann (1995), "Intervention Strategies and Exchange Rate Volatility: A Noise Trading Perspective", *Federal Reserve Bank of New York Working Paper No. 9515*, June.

Humpage, Owen F. (1989), "US Intervention: Assessing the Probability of Success", *Federal Reserve Bank of Cleveland Working Paper No. 9608*, Sept.

Jalan, Bimal (2000), "Development and Management of Foreign Exchange Markets: A Central Banking Perspective", Inaugural Remarks at the 21st Asia pacific Congress held in New Delhi on December 1.

Jorion, Philippe (1995), "Predicting Volatility in the Foreign Exchange Market", *Journal of Finance*, June, 50, 507-528.

Kaminsky, Graciela and Karen Lewis (1993), "Does Foreign Exchange Intervention Signal Future Monetary Policy ?", *NBER Working Paper No. 4298*.

Karunaratne, N.D. (1995), " The Effectiveness of Intervention in Post-float Australia", *Economica Internationale*.

Kearney, Colm and Ronald MacDonald(1986), " Intervention and Sterilization under Floating Exchange Rates: The UK 1973-1983", *European Economic Review*, 30, April.

Kim, S. J. and J. Sheen (2002), "The Determinants of Foreign Exchange Intervention of Central Banks: Evidence from Australia", *Journal of International Money and Finance*, vol.18, No.5.

Klein, Michael and Karen Lewis (1991), "Learning About Intervention Target Zones", *NBER Working Paper No. 3674*.

Klein, M.W. (1993), "The Accuracy of Reports of Foreign Exchange Intervention", *Journal of International Money and Finance*, 12, 644-653.

Leahy, M.P. (1995), " The Profitability of US Intervention in the Foreign Exchange Market", *Journal of International Money and Finance*, Vol.14, No.6, Dec.

Lewis, K.K. (1995), "Are Foreign Exchange Intervention and Monetary Policy Related and Does it Really Matter?", *Journal of Business*, 68, 185-214.

Loopesko, Bonnie (1984), "Relationships Among Exchange Rates, Intervention and Interest Rates: An Empirical Investigation", *Journal of International Money and Finance*.

Neely, Christopher and Paul Weller (1997), "Technical Analysis and Central Bank Intervention", *Federal Reserve Bank of St. Louis*, January 23.

Obstfeld, Maurice (1988), "The Effectiveness of Foreign Exchange Intervention: Recent Experience", *NBER Discussion Paper No. 2796*.

" (1983), " Exchange Rates, Inflation, and the Sterilization Problem: Germany 1975-1981", *European Economic Review*, 21, March.

Pattanaik, Sitikantha (1999), " REER: The Leading Indicator", *Reserve Bank of India Occasional Papers*, Vol.20, No.2, Monsoon.

" (1997), " Target and Instruments for the External Sector with an Open Capital Account", *Economic and Political Weekly*, Vol. XXXII, No. 40, October 4.

Pattanaik, Sitikantha and A.K. Mitra (2001), " Interest Rate Defence of Exchange Rate: Tale of the Indian Rupee", *Economic and Political Weekly*, Vol. XXXVI, Nos. 46 and 47, Nov.24.

Patra, M.D. and Sitikantha Pattanaik (1998), " Exchange Rate Management in India: An Empirical Evaluation", *Reserve Bank of India Occasional Papers*, Vol.19, No.3, Sept.

Pilbeam, Keith (1991), *Exchange Rate Management: Theory and Evidence*, MacMillan.

Rogoff, Kenneth (1984)," On the Effects of Sterilised Intervention: An analysis of Weekly Data", *Journal of Monetary Economics*, 14, Sept.

Rose, Andrew K. (1996), " Explaining Exchange Rate Volatility: An Empirical Analysis of the Holy Trinity of Monetary Independence, Fixed Exchange Rates, and Capital Mobility", *Journal of International Money and Finance*, Vol.15, No.6.

Rosenberg, Michael R. (1996), "Central Bank Intervention and Determination of Exchange Rates", in *Currency Forecasting*, Irwin Professional Publishing, London.

Sarno, Lucio and M. P. Taylor (2001), "Official Intervention in the Foreign Exchange Market: Is It Effective and, If So, How Does It Work?", *Journal of Economic Literature*, Vol.39, 839-868.

Spencer, P. (1985), " Official Intervention in the Foreign Exchange Market", *Journal of Political Economy*, Vol.93, 1019-1024.

Stiglitz, Joseph E. (1999), " Lessons from East Asia", *Journal of Policy Modeling*, 21(3).

Taylor, D. (1982), "Official Intervention in the Foreign Exchange Market", *Journal of Political Economy*, 90, 356-368.

Turnovsky, Stephen J. (1985), "Exchange Market Intervention under Alternative Forms of Exogenous Disturbances", *NBER Working Paper No. 1289*, April.

Annexure-I

Effectiveness of Central Bank Intervention: Empirical Evidence from Select Studies

Authors (Year)	*Empirical Findings*
Kim, S. J. and J. Sheen (2002)	Intervention operations of the Reserve Bank of Australia (RBA) during 1983 to 1997 were guided by five major considerations, *viz.* trend corrections in exchange rate, volatility smoothing, US-Australia overnight interest rate differentials, profitability and foreign currency reserve inventory. Intervention related profits of RBA were normally close to zero from 1983 to 1988 and in the subsequent years major losses were sustained upto 1997.
Frenkel, M. C. Pierdzioch and G. Stadtman (2001)	Using the very short intervention record of the European Central Bank, the study concluded that interventions were not effective. While intervention had some effect on the level of the exchange rate in the intra-daily exchange rate data, those effects were only minor and got reversed on the trading day following the intervention.
Sarno, Lucio and M. P. Taylor (2001)	By reviewing the existing literature, the study concluded that studies of the 1990s are largely supportive of intervention effectiveness whereas those of the 1980s largely rejected the hypothesis that intervention could be effective.
Galati, G. and Williams Melick (1999)	The paper examined how market expectations affected the likelihood of Central Bank intervention and, in turn, how intervention affected market expectations. It concluded that the Bank of Japan and the Fed responded quite differently. Most importantly, interventions increased market uncertainty regarding future movement of spot rates.
Paolo Vitale (1997)	In a market micro-structure framework, the results of this study showed that in some circumstances sterilized intervention may represent an instrument to influence exchange rate.
Baillie, R. and W.P. Weferberg (1997)	Using daily intervention data from July 6, 1986 to March 1, 1990 for the G-3, the paper studied the intervention effectiveness in the US$/DM and US$/Yen spot markets and concluded that interventions may tend to increase volatility rather than calming disorderly conditions.

Authors (Year)	***Empirical Findings***
Bonser-Neal (1996)	Using daily intervention data for the G-3 over 1985 to 1991 the study concluded that interventions typically had little effect on exchange rate volatility and in some cases interventions even increased volatility.
Karunaratne, N.D. (1995)	This study contradicted the Juttner and Tonkin (1992) findings that Reserve Bank of Australia's interventions were futile and ineffective and out-rightly damaging to Australia's macro-economic performance. It also contradicted the RBA claims that its sterilised interventions were mainly for "leaning against the wind" since there were instances of sporadic heavy doses of intervention since mid-80s aimed at achieving a variety of stabilisation goals.
Huang, Juann (1995)	US interventions reduced both yen/dollar and DM/dollar exchange rate volatilities during 1985-86, but increased them during 1987-89. These results make sense in a noise trading framework where the effectiveness of sterilised intervention may depend critically on the shrewdness of intervention strategies.
Almekinders and Eijffinger (1994)	Using daily data from February 23, 1987 to October 31, 1989, they found that interventions conducted by the Bundesbank and the Federal Reserve were not successful at systematically reversing unwanted movements in the respective exchange rates. [They contradicted the findings of Dominguez and Frankel (1993)].
Catte, Galli and Rebecchini (1994)	This study identified 19 episodes of coordinated intervention and found that all episodes were successful in temporarily reversing the trend movement in the US dollar.
Weber (1994)	Sterilised intervention, whether coordinated or not, has no lasting effect on exchange rates.
Andrew and Broadbent (1994)	According to this study, whether any intervention is stabilising or not cannot be directly observed since the behaviour of the exchange rate in its absence is unknown. Using Friedman's "profit tests", it showed that RBA profited from its intervention operations, indicating that interventions were stabilising.
Dominguez, K.M. (1993)	Using GARCH models on $/DM and $/yen daily data over the period 1985 to 1991, the study concluded that publicly known interventions generally decreased

Authors (Year)	***Empirical Findings***
	volatility. Secret intervention operations by both the Fed and the Bundesbank increased exchange rate volatility.
Dominguez and Frankel (1993)	Using daily data they showed that even sterilised interventions can influence the exchange rates, particularly when known to the markets.
Ghosh A. (1992)	The study supported the view that sterilised intervention operating through the portfolio channel is statistically significant but quantitatively unimportant. To materially influence the exchange rate, substantial intervention is required so as to operate through the portfolio balance channel.
Klein and Lewis (1991)	They found that neither the Federal Reserve nor the Bundesbank had used intervention as a signal of future policy changes. Intervention did not consistently precede policy changes, and a large number of policy changes were not preceded by intervention in the post-Plaza period.
Pilbeam, Keith (1991)	Interventions by the Bank of England, which were mostly sterilised, had no significant exchange rate effects. The authorities made profits when net intervention was close to zero. They generally lost money, when net cumulative interventions turned out to be large.
Dominguez, K. M. (1989)	Coordinated intervention is generally statistically significant and of the correct sign and is reported to be quantitatively more important than non-coordinated intervention.
Humpage (1989)	The study concluded that: (1) systematic intervention had no apparent impact on exchange rates, (2) intervention can have a short-term effect if it provides new information to the market, and (3) distinction between coordinated and non-coordinated intervention is not important.
Obstfeld Maurice (1988)	Sterilised intervention, in itself, played an un-important role in promoting exchange rate realignment. The signaling channel worked occasionally due to the readiness of the authorities to adjust monetary policy promptly to counteract unwelcome exchange market pressures.

Authors (Year)	***Empirical Findings***
Danker *et al.* (1987)	None of the alternative models could confirm that sterilised intervention can be effective.
Kearney & MacDonald (1986)Kearney & MacDonald (1986)	They concluded that sterilised intervention does appear to have a substantial (quantitatively important) effect on the exchange rate.
Dominguez (1986)	The study examined whether a relationship existed between intervention and weekly money surprises. During periods when the Fed's anti-inflation credibility was high, there was evidence that money supply surprises were positively correlated with intervention. When credibility was high, intervention had a significant positive impact on the exchange rate.
Blundell-Wignall & Masson (1985)	Estimates of portfolio balance equations indicated that sterilised intervention had a statistically significant but quantitatively unimportant effect. When the purpose of intervention is to limit exchange rate overshooting, evidence provides little justification for such actions.
Boothe *et al.* (1985)	Examining the effectiveness of sterilised intervention by Bank of Canada, the study showed that movements in estimated risk premiums were not related to asset stocks. Thus, intervention could only be effective if it can influence expectations.
Rogoff (1984)	Estimated impact of relative asset supplies on exchange rates was found to be insignificant and of the wrong sign.
Loopesko (1984)	In at least one sub-sample period, sterilised intervention was found to be effective through the portfolio balance channel for 5 of the 6 exchange rates examined. However, when all sub-sample periods were examined, one-half of the cases did not support the existence of a portfolio balance channel. Evidence suggested that coordinated intervention may have a significantly greater impact on exchange rates than non-coordinated intervention.
Obstfeld (1983)	Simulation experiments suggested that the Bundesbank's ability to influence the DM/U.S.$ exchange rate using sterilised intervention was very limited.

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International Business Cycles Beyond G-7: The Case of India

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This paper examines the co-movements of business cycle in India, Germany, Japan, UK and USA during 1950-2000. In view of the largely closed nature of Indian economy and the dominant role of the public sector during the early period, it is interesting that the Indian business cycles have some correspondence with the business cycles in UK and also with the USA especially in the post-1980 period. The roles of foreign trade, foreign capital investment, oil-price shocks and other global shocks as the possible source of common linkage are also studied. It is shown that the oil price shock is the dominant global shock linking the economies under consideration.

JEL Classification: E32, F41

Key words: International Business Cycles, Macroeconomic fluctuations, Investment Cycles, Oil Shocks

Introduction

With the increasing interaction among national economies, there is more synchronisation in the level of economic activities of nations. This is more visible in the developed industrial economies where there are strong linkages in production of goods and services and also in financial flows. As developing countries become more integrated with the world economy, macroeconomic fluctuations in these countries have become increasingly affected by external influences, including business cycles in advanced countries. This has stimulated increased attention to the study of the linkages between the cyclical fluctuations in the developed and the developing countries.

This paper attempts to investigate the relationship between the cyclical movements in India and the major developed industrial countries during 1950-2000. During this period, India has been a mixed economy with roles for both the public sector and the private sector in the production process. In the post-1980 period, investment

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in private sector has picked up and the role of public sector has gradually declined (Annexure I). The economy was growing at an average rate of 3.4 per cent in the 1970s and picked up during the subsequent period. The trend growth was over 5 per cent in 1980s and around 6 per cent in 1990s. The share of external trade in GDP also increased over the 1980s and 1990s.

It was considered appropriate to study the relationship with the individual major trading partner countries rather than studying them *vis-à-vis* an artificially aggregated economy. This has been done to avoid the problems in aggregating economies with different structures that often do not behave similarly and many important country-specific features get cancelled out in the process of aggregation. The relationship between the Indian business cycles and the business cycles in USA, UK, Germany and Japan have been investigated as these are the major trading partners of India and are also the major countries with investments in India.

The remainder of the paper is organised in six sections. Section I briefly reviews the major studies in this area. Section II discusses the possible channels of the transmission of business cycles to the Indian economy. Section III presents the methodology and the data sources. Section IV presents the stylised facts relating to the relationship between the cyclical fluctuations in the selected economies and also discusses the impact of capital inflows. Section V analyses the impact of common shocks through a structural VAR model. Concluding remarks are given in Section VI.

Section I

Review of the Previous Studies

Backus and Kehoe (1992) examined the international evidence on the historical properties of business cycles in respect of major industrial countries. Zimmermann (1995) studied the business cycle behaviour of trade related aggregates and prices in 19 industrialised countries and compared those facts with the computational experiments of international real business cycle models. A'Hearn and Woitek (2001) studied the historical properties of business cycle for US,

Russia, Canada, Australia and major European countries for 1866-1913 and found a fairly long cycle with a periodicity of 7-10 years in all countries. They also found some evidence of a less regular and less powerful short cycle of 3-5 years duration. Canova and Dellas (1993) developed a stochastic general equilibrium model of the world economy to analyse the contribution of trade interdependence to propagation of international business cycles. Baxter (1995) developed a general equilibrium model of two countries producing a single consumption-investment good with frictionless trade and analysed its business cycle implications. It also discusses the volatility of current account and effects of shocks to government spending. Kouparitsas (1996) developed a quantitative general equilibrium model of North-South trade and argued that fluctuations in Northern aggregate output account for about 70 per cent of the variation in Southern hemisphere.

Using a Bayesian dynamic latent factor model for estimating common components in main macroeconomic aggregates, Kose *et al* (2000) investigated the common dynamic properties of business cycle fluctuations across countries, regions and the world. Their results showed that the world factor is an important source of volatility and the region-specific factors play only a minor role in explaining fluctuations in economic activity. Kwark (1999) found that the country-specific shocks to the US are important in explaining domestic and foreign (non-US G-7 countries) output fluctuations although foreign output fluctuations are partly explained by global shocks.

Canova and Marrinan (1998) studied the generation and transmission of international cycles in a multi-country model with production and consumption interdependencies. They found that a common component in the shocks best accounts for the empirically observed output dynamics and also provided evidence that country-specific shocks to the US induce comovements in the output cycles in Germany and Japan. Prasad (1999) found that nominal shocks have been an important determinant of the forecast error variance for fluctuations in the trade balance of G-7 countries in the post-Bretton Woods period. Canova and de Nicolo (2000) found that demand shocks are the dominant source of fluctuations in output,

inflation and term structure of interest rates in six of the G-7 countries and, within the class of demand disturbances, the importance of nominal shocks declined after 1982. Glick and Rogoff (1995) developed an analytically tractable empirical model of investment and the current account and found that the distinction between global and country-specific shocks turns out to be quite important for explaining current account behaviour of G-7 countries.

Lumsdaine and Prasad (1997) used time-varying weights for constructing the common component in international economic fluctuations. They found evidence for a world business cycle and also for a distinct European common component. They also found systematic differences in international business cycle relationships between the Bretton Woods and post-Bretton Woods periods. Assuming the industrial production in G-7 countries to be driven by two exogenous disturbances, Gross (2001a) found that the theoretical predictions of an open-economy model with common exogenous shocks are largely consistent with the stylised facts of the international business cycle and that country-specific and global shock appear to be equal candidates for explaining output fluctuations at business cycle frequencies across major industrialised countries. Gross (2001b) found that idiosyncratic supply shocks potentially induce changes in the current account and foreign output that vary in direction and magnitude across G-7 countries.

The relationship in business cycle fluctuations across countries also depends on the origin and magnitude of the disturbances. Economic growth of the outward-looking developing countries with capital mobility is likely to be significantly influenced by the developments in major industrial countries with which they have close trade and investment links. On the other hand, the growth pattern of inward-looking developing countries with restrictions on international capital movements is less likely to be affected by international business cycles. The literature on international business cycle has generally dealt with the co-movements in marcoeconomic fluctuations in the United States and major West-European countries with some studies also covering Canada, Australia and Japan. There has been no attempt to relate it with the similar phenomenon in other developing countries individually. The recent studies relating

the various groups of countries (Kouparitsas 1996, Kose *et al* 2000, IMF 2001) suffer from problems of aggregation due to huge differences within the economic structures and regimes in countries of the "South" and non-conformity between business cycles within the "North". A study of this phenomenon in the case of a major developing economy like India and selected major developed countries would help to examine the extent of impact of international capital inflows and trade and the effect of common shocks like the changes in oil prices over different phases of international business cycle.

Section II

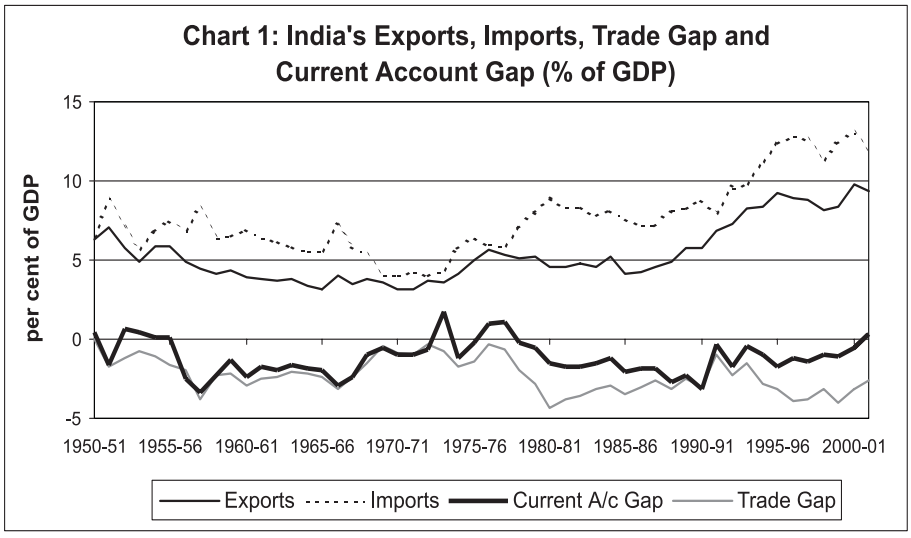
Channels of International Business Cycle Transmission

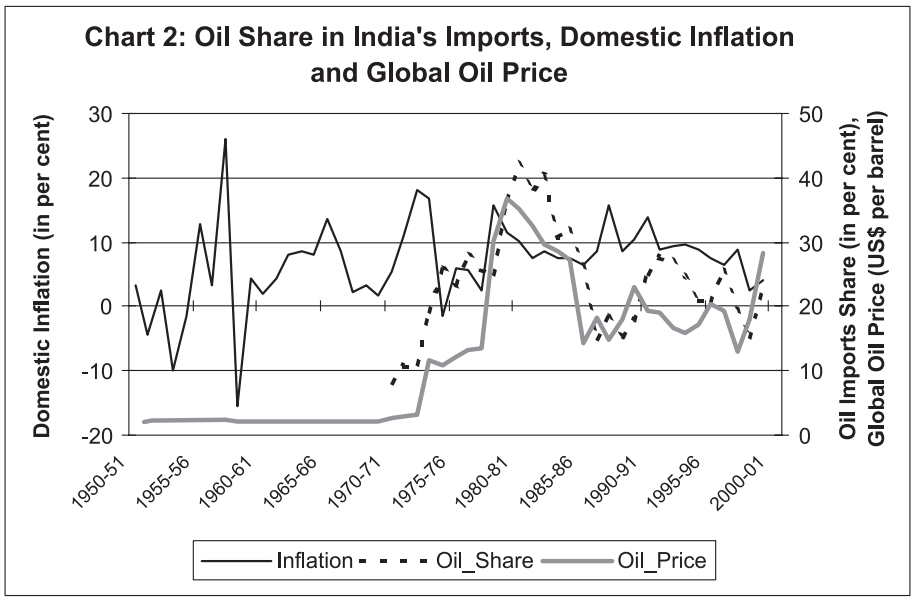
The major possible channels of synchronisation of cycles between the developed and the developing countries are common shocks, trade channel of transmission and financial market channel of transmission. Events with global impact like the oil-price shocks in the 1970s can be classified as common shocks. The depth of trade interdependence decides the strength of trade-related spillover out of disturbances in one or more countries. The integration of international financial markets and also the other international capital flows provide another strong linkage for international business cycle movements.

The OECD countries account for a major share of Indian trade (Appendix II). The oil-exporting countries are the other major trading partner block where the balance of trade is against India on account of high oil import bill. USA, UK, Germany and Japan are the four major trading partners of India. After the European unification, Belgium has become an important trading partner and is an intermediate origin/destination (largely because it has some major ports of Europe) for trading goods with other European countries, especially Germany, as the ultimate destination.

Current account deficit has been generally lower than the trade deficit in India (largely on account of high net invisibles receipts) (Chart 1). The share of both exports and imports in GDP were declining during the first two decades largely on account of the

import substitution policy followed by the country. This trend in imports was reversed in 1970s and the significant increase in import bills was prominent during the two oil price shocks in the 1970s. Due to liberalisation of trade policy announced in the late 1980s and 1990s, there has been an acceleration in both imports and exports subsequently.





The international oil prices have a major influence on the world economy since the 1970s. The increases in global oil prices resulted in substantially inflated oil import bill for India and were also followed by high domestic inflation (Chart 2). With juxtaposition on Chart 1, it can be seen that other imports were reduced with increasing oil-imports bill during the periods of oil price shocks. As oil shocks were the most prominent common shocks during the reference period for the economies under consideration, this phenomenon is examined in detail later in this paper.

Section III

Methodology and Data Sources

The official quarterly estimates of national income and related aggregates for India are available only since April-June quarter of 1995 and therefore, annual estimates for 1950-2000 are used for this analysis. Data in respect of India are taken from the official sources like the publications of the Central Statistical Organisation and the Reserve Bank of India. The estimates for other countries are taken from the International Financial Statistics (IFS) database of the International Monetary Fund (IMF). In view of the German Unification in 1989, consistent long-term time series on certain major macroeconomic variables are not available and, therefore, the relationship has been explored only for the pre-unification period in respect of Germany. In the case of India, cyclical fluctuation in the non-agricultural GDP is taken as output cycle instead of total GDP as agricultural output in India is largely weather dependent and interaction of market forces has lesser role to play in determining its level. Also the cyclical component of non-agricultural output is more strongly related to cyclical components of other macro variables like private consumption, investment, manufacturing sector output, value added from domestic trade, construction activity, private corporate sector output and sales (Mall 1999).

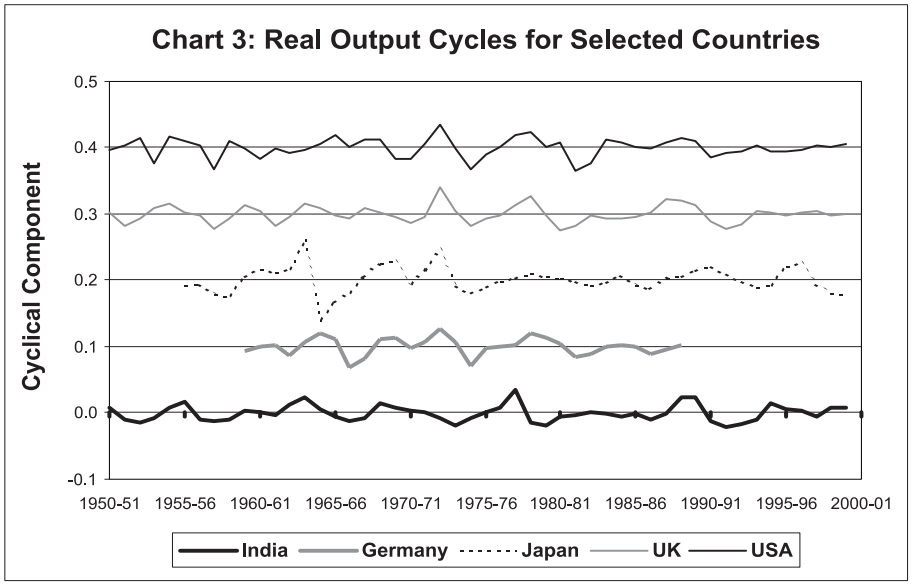
The cyclical components of annual economic time series are estimated by using the band-pass filter proposed by Baxter and King (1999) which uses the frequency domain approach and allows the users to choose the band of cyclical component. For estimating

the cyclical components, log transformation of the annual series has been taken and the band-pass filter is used to isolate the component of time series lying within a band of frequencies between two to eight years.

Section IV

International Business Cycles and India – The Correspondence

Among the four developed industrial countries, the business cycle movements are varied from strong (UK & USA, Germany & USA and Germany & UK) to weak (Japan & UK and Japan & USA) (Table 1 and Chart 3). There has been a change in the pattern of relationship over time, for example, the Germany/USA relationship has become stronger over time (post-1960 correlation of 0.56 increased to 0.83 in the post-1970 period) whereas the Japan/USA relationship has been moving in opposite direction (post-1970 correlation was 0.40 which changed to -0.06 in the post-1980 and further to -0.72 in the post-1990). The Germany/Japan



Note: Curves have been shifted up for illustrative purposes.

relationship became more significant in the post-1970 period. The positive impact of the 1970s (the major oil-shock period) on the relationship is obvious.

Table 1: Correlation of the Output Cycles for Selected Countries (1950-2000)

Country / Period		USA	UK	Japan	Germany
With India	All Period	0.09	0.35	0.20	0.08
	Post-60	0.13	0.30	0.18	0.08
	Post-70	0.22	0.27	-0.03	-0.18
	Post-80	0.35	0.65	0.01	0.08
	Post-90	0.37	0.71	-0.23	N.A.
With Germany	All Period	0.56	0.46	0.25	
	Post-60	0.56	0.49	0.25	
	Post-70	0.83	0.64	0.77	
	Post-80	0.86	-0.13	0.45	
	Post-90	N.A.	N.A.	N.A.	
With Japan	All Period	0.09	0.31		
	Post-60	0.07	0.27		
	Post-70	0.40	0.39		
	Post-80	-0.06	-0.04		
	Post-90	-0.72	-0.29		
With UK	All Period	0.56			
	Post-60	0.62			
	Post-70	0.72			
	Post-80	0.47			
	Post-90	0.64			

N.A. – Not Available

The nature of relationship of output cycles in India with the output cycles in the other four countries is very interesting. There is a positive relationship between the Indian and the UK output cycles and it has strengthened over time. Due to historical reasons, India has strong trade relationship with the UK. The co-movement between output cycles of India and the USA is also increasing especially during the 1980s and the 1990s. There is no significant relationship of the Indian output cycles with those in Germany and Japan. The amplitude of cycles are good measure of severity of the downturn / recovery and a cycle with higher amplitude is likely to result in more impact on the trading partners. High cyclical amplitude signifies high impact of cyclical fluctuations in the economy. The amplitude of cycles (measured by standard deviation of the cyclical components) is highest for Japan (0.0203) followed by USA (0.0145), Germany (0.0134), UK (0.0132) and India (0.0124). This implies that cyclical fluctuations have more profound influence on the Japanese economy than the remaining countries.

Investment and private consumption in the selected countries are taken as other major variables for analysing the international business cycle relationship. It is interesting to note that there is a strong relationship between the private consumption cycles and the investment cycles in respect of the USA and the UK and also between the USA and Germany (Table 2). However, the same cannot be said for Japan. The co-movements of the cyclical components of investments for Germany and Japan are significant in the post-1970 period as in the case of their output co-movement during the same period but the same cannot be said for their private consumption relationship. In the case of India, the relationship with all the countries for the whole period is found negative for both private consumption and investment but turned positive for the post-1980 period. The private consumption behaviour is greatly influenced by the volatility in agricultural output. During the pre-1980 period, investment behaviour in the Indian economy was largely driven by government policies and was not necessarily driven by market forces. The public sector industries had a major share in total investment in the pre-1980 period and their share has been declining in the subsequent period. The opening up of the economy around mid-1980s witnessed more syncronised movements in these variables with other countries especially with the USA and the UK.

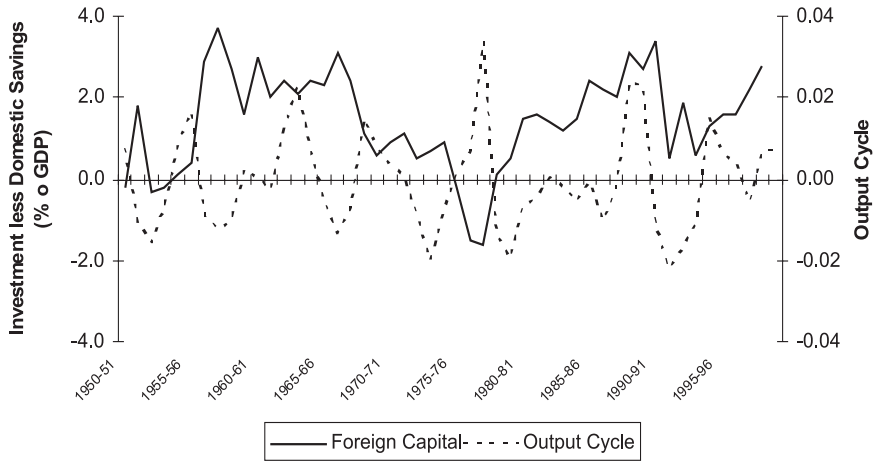
Table 2: Cross-country Correlation of Cyclical Components of Consumption and Investment in Selected Countries

Country / Period		USA	UK	Japan	Germany
Private Consumption Expenditure					
India	**Post-1950**	-0.11	-0.10	-0.07	-0.34
	Post-1970	-0.14	-0.13	-0.32	-0.28
	Post-1980	0.32	0.52	0.13	0.15
Germany	**Post-1950**	0.45	-0.15	-0.03	
	Post-1970	0.48	-0.04	0.44	
	Post-1980	0.14	-0.58	-0.24	
Japan	**Post-1950**	0.05	0.34		
	Post-1970	0.26	0.34		
	Post-1980	-0.17	0.09		
UK	**Post-1950**	0.42			
	Post-1970	0.66			
	Post-1980	0.64			
Gross Fixed Capital Formation					
India	**Post-1950**	0.01	0.04	0.01	0.02
	Post-1970	-0.20	-0.13	-0.32	-0.19
	Post-1980	0.22	0.27	0.14	-0.04
Germany	**Post-1950**	0.33	0.06	0.20	
	Post-1970	0.52	0.14	0.55	
	Post-1980	0.62	-0.08	0.22	
Japan	**Post-1950**	0.01	0.32		
	Post-1970	0.29	0.38		
	Post-1980	-0.17	0.20		
UK	**Post-1950**	0.38			
	Post-1970	0.44			
	Post-1980	0.48			

Foreign Investment

The negative correlation between investment cycles in India and those in other countries for the post-1980 period is significant. On an average, over 92 per cent of investment in India is met with domestic savings (Appendix I). However, external investment had an important role (except in the 1970s when it went down drastically and was negative for three years). Chart 4 presents the share of foreign investment (as per cent of GDP) and the output cycles. These movements had low correlation in the total period (correlation coefficient = 0.10). However, a closer look shows that there is a significant difference in the relationship between the pre-1980 and the post-1980 – the pre-1980 relationship was negative (correlation coefficient = -0.28) which turned positive in the post-1980 (correlation coefficient = 0.41). The direction of causality between output cycles and foreign investment cannot be studied from these two variables as there are other factors like the state of the foreign economies, government policies, investment lags, *etc.*, that influence the relationship but the growing association between foreign investment and output cycles is extremely important. This result is consistent with the overall output, consumption and investment cycle relationship during the post-1980s when there was stronger co-movement with the USA and the UK – the two major investing countries in India.

Chart 4: Foreign Capital Investment and Output Cycles



Section V

The Role of Common Shocks – A Theoretical Model

In this section, we study the the impact of common global shocks (including the oil-shocks) and country-specific shocks in propagating similar macroeconomic fluctuations across the selected countries. For this purpose, a structural VectorAutoregression (VAR) model using quarterly data for the period 1960:Q1 to 2000:Q4 is used. For this analysis, the Index of Industrial Production (IIP) has been used as output variable for all the countries. Two quarterly VAR models are used to analyse -

(i) the impact of global shocks and country-specific shocks on output fluctuations; and

(ii) the impact of oil price shocks, other global shocks and country-specific shocks on output fluctuations.

To discriminate between country-specific and global shocks, it is assumed that impacts of global shock produce identical percentage output changes across countries and their limiting impulse responses in the level of output are also assumed identical across countries.

The output series (i.e., seasonally adjusted quarterly IIP) are found to be I(1). In view of its large size and strong trade relationship with the major economies across the globe, USA is taken as the reference country and the output differential with respect to the USA is defined as

$$Y^i = \Delta\log(IIP^i) - \Delta\log(IIP^{US}) \quad (1)$$

where i denotes the other four countries. The assumption that $Y = [Y^i, \Delta\log(IIP^i)]$ be a bivariate covariance stationary vector process for any i would imply that the elements of Y can be expressed as a linear combination of past and present structural shocks, i.e.,

$$Y_t = A(L)\ \varepsilon_t \quad (2)$$

where $\varepsilon = [\varepsilon^h , \varepsilon^g]^T$ is a vector of serially uncorrelated structural disturbances with zero mean and unit variance, h and g representing the home and global supply shocks, and A(L) is a 2×2 matrix of polynomial lags. The reduced form moving average representation

of Y is

$$Y_t = C(L) \quad e_t \tag{3}$$

where e = [e_1 , e_2] is a non-structural residual vector with zero mean and variance-covariance matrix Σ, and C(L) = A(L) × S^{-1} is a 2×2 matrix of polynomial lags to be estimated and S is a 2×2 matrix to be identified. The elements of e are linear combinations of the structural shocks by

$$e_t = S \times \quad \varepsilon_t \tag{4}$$

which implies (with nomalisation $E(\varepsilon_t \varepsilon_t^T) = I$) that $\Sigma = S \times S^T$. This imposes three non-linear restrictions on the S matrix by the estimates of Σ. To recover the original VAR structure (by identifying the S matrix) by just-identification, we assume additional restriction from economic theory that global supply shock does not have long-run impact on the differential of the output level across countries. The VAR is estimated for the lag order 3 as residuals do not contain significant autocorrelations beyond the third lag.

A similar structure is used for the second VAR analysis that includes three shocks and Y is now defined as Y = [Y^i, Δ log(IIP^i), Δ log($Price_{oil}$)]. To just-identify the model, the additional restriction that oil price is solely driven by oil price shocks (*i.e.,* country-specific and global shocks have zero coefficient for the oil price equation) is imposed.

The correlation between the country-specific shocks and the global shocks before and after the oil price adjustment indicates that the the country-specific shocks are generally unrelated across the countries both before and after oil price adjustments (Table 3). In the case of India, the correlation with all other countries is less than 0.1 for country-specific shocks. In the case of Japan, the correlation with the UK or India is negligible and negative but it is marginally high with Germany. In Section IV too, the relationship in cyclical components of both output and investment in Germany and Japan were found to be high. Similar is the case with UK-Germany relationship. On the other hand, the global shocks have been more strongly related than the country-specific shocks across the countries both before and after oil price adjustments. There has been no major change in the pattern of correlations if oil price

shocks are explicitly accounted for. This result is consistent with the findings of Gross (2001a). Additional calculations show that the impacts of oil shocks are near-perfectly correlated across countries (the correlation coefficient ranges between 0.991 to 0.996). This implies that oil shocks are the dominant source of business cycle comovements in the selected countries.

Table 3: Cross sectional Covariance of Identified Shocks: Global and Country-Specific Shocks Before/After controlling for Oil Prices

Country	UK	Japan	Germany	UK	Japan	Germany
	Before Oil price Adjustment			After Oil price Adjustment		
Country-Specific Shocks						
India	-0.004	-0.052	0.073	-0.007	-0.093	0.060
Germany	0.284	0.226		0.267	0.225	
Japan	-0.034			-0.008		
Global Shocks						
India	0.403	0.441	0.481	0.477	0.433	0.455
Germany	0.422	0.409		0.445	0.402	
Japan	0.185			0.243		

Section VI

Concluding Observations

The global economy is becoming increasingly integrated under the influence of a variety of factors like increasing trade in goods, greater technological spillover and increasing factor mobility especially, international capital flows. Over the years, this has resulted in international business cycle linkages in the developed industrial countries in Europe and they often have phases of synchronised relationship with the US business cycles. However, its relationship with other parts of the world is not yet strong. The Japanese business cycle is one such example. In view of the non-synchrony and changing structures, international business cycle analysis using artificially aggregated economy is prone to cancelling out many interesting and relevant country-specific factors.

The analysis in this paper shows that the Indian output cycles have positive relationship with the UK output cycles and also with the USA output cycles especially during the post-1980s, though the latter relationship is weaker than the former. Also, the relationship between Indian investment or private consumption cycles and the respective cycles in other selected countries turned positive in the post-1980 period. This can largely be attributed to the closed nature of Indian economy and the institutional set-up in the earlier years. This relationship has undergone changes in the light of the declining public sector investment and also due to the opening up of the economy which has led to increased factor movements with other economies.

The synchronised output cycles can largely be related to the international oil price shocks for all the countries. Though non-oil global shocks were important in transmission of international business cycles, the oil price factor which cannot be considered endogenous to the economies analysed here, has been the dominant factor driving the international business cycle relationship through global shocks for major part of the period.

Appendix I:
Indian Economy - Selected Ratios & Growth Rates

(A) Selected Ratios

Variable	**1950-51**	**1970-71**	**1980-81**	**1990-91**	**2000-01**
Activity Share in Output (in %)					
Agriculture & Allied Activities	55.8	45.2	38.1	31.0	25.3
Mining, Manufacturing & Electricity	12.4	17.0	20.9	23.3	20.2
Services	31.8	37.8	41.0	45.7	54.5
Average Saving Rate (% of GDP)	10.8	13.5	18.9	19.3	23.1
Average Investment Rate (% of GDP)	12.0	15.6	19.1	22.0	24.3
Public Sector share in GDP (per cent)	NA	13.8	19.7	26.3	25.7
Public Sector share in Investment (per cent)	NA	38.1	41.4	38.6	31.1
Degree of Openness	**1950-60**	**1960-70**	**1970-80**	**1980-90**	**1990-00**
Exports (% of GDP - Average)	5.7	3.9	4.4	4.7	8.0
Imports (% of GDP - Average)	7.5	6.2	5.6	8.0	10.9
Current Account (% of GDP - Average)	-1.0	-1.8	-0.1	-1.8	-1.3

(B) Selected Growth Rates - per cent per annum (Average of Decades)

Variable	**1950-60**	**1960-70**	**1970-80**	**1980-90**	**1990-00**
Trend Annual Growth rate (based on Real GDP)	3.6	3.2	3.4	5.2	6.0
Trend Annual Inflation (based on GDP deflator)	1.2	7.3	7.6	7.8	8.2

Source: Compiled from-

(i) National Accounts Statistics, Central Statistical Organisation

(ii) Reserve Bank of India Bulletin

Appendix II:
Share of Selected Countries in India's Foreign Trade

(per cent)

Year\ Country		Belgi-um	Germa-ny	UK	USA	Japan	Saudi Arabia	Singa-pore	Hong-kong	USSR
1950-51	Exports	1.6	1.8	23.3	19.2	1.7	0.4	4.7	1.7	0.2
	Imports	1.4	1.6	20.8	18.3	1.6	0.1	2.5	0.4	0.0
1960-61	Exports	0.8	3.1	26.8	16.0	5.5	0.5	1.1	0.5	4.5
	Imports	1.4	10.9	19.4	29.2	5.4	1.3	0.9	0.1	1.4
1970-71	Exports	1.3	2.1	11.1	13.5	13.3	0.9	1.3	1.2	13.7
	Imports	0.7	6.6	7.8	27.7	5.1	1.5	0.1	0.0	6.5
1980-81	Exports	2.2	5.7	5.9	11.1	8.9	2.5	1.7	2.2	18.3
	Imports	2.4	5.5	5.8	12.1	6.0	4.3	3.4	0.3	8.1
1990-91	Exports	3.9	7.8	6.5	14.7	9.3	1.3	2.1	3.3	16.1
	Imports	6.3	8.0	6.7	12.1	7.5	6.7	3.3	0.7	5.9
1999-00	Exports	3.7	4.8	6.0	22.7	4.5	2.0	1.8	6.8	2.9
	Imports	7.4	4.0	5.8	7.7	5.0	4.8	3.2	1.7	1.7

Source: Compiled from

(i) Handbook of Statistics on Indian Economy, Reserve Bank of India

(ii) India Database: The Economy (H.L.Chandok and The Policy Group, 1989)

References

A'Hearn, Brian and Ulrich Woitek (2001): More International Evidence on the Historical Properties of Business Cycles, *Journal of Monetary Economics,* Vol 47, pp 321-46.

Backus, D.K. and P.J.Kehoe (1992): International Evidence on the Historical Properties of Business Cycles, *American Economic Review,* Vol. 82, pp 864-88.

Baxter, Marianne (1995): International Trade and Business Cycles, in Grossman, Gene M. and Kenneth Rogoff: *Handbook of International Economics* (Vol.3), Elsevier Science Publishers B.V.

Baxter, Marianne and Robert G. King (1999): Measuring Business Cycles: Approximate Band-Pass Filters for Economic Time Series, *Review of Economics and Statistics,* pp 575-93.

Baxter, Marianne and Michael A.Kouparitsas (2000): What can Account for Fluctuations in the Terms of Trade, *Federal Reserve Bank of Chicago Working Paper.*

Canova, Fabio and Harris Dellas (1993): Trade Interdependence and the International Business Cycle, *Journal of International Economics,* Vol 34, pp 23-47.

Canova, Fabio and Jane Marrinan (1998): Sources and Propagation of International Output Cycles: Common shocks or Transmission? *Journal of International Economics,* Vol. 46, 133-66.

Canova, Fabio and Gianni de Nicolo (2000): On the Sources of Business Cycles in the G-7, *Working Paper.*

Central Statistical Organisation, India: *National Accounts Statistics* (various issues)

Chandok, H.L (1989): *India Database: The Economy,* The Policy Group, New Delhi

Dellas, Harris, (1986): A Real Model of the World Business Cycle, *Journal of International Money and Finance,* Vol. 5, pp 381-94.

Fisher, Eric O'N (1995): Growth, Trade and International Transfers, *Journal of International Economics,* Vol.39, 143-58.

Glick, Reuven and Kenneth Rogoff (1995): Global Versus Country Specific Productivity Shocks and the Current Account, *Journal of Monetary Economics,* 159-192

Gross, Daniel (2001a): Country-Specific and Global Shocks in the Business Cycle, *Working Paper* No.2001/11, Center for Financial Studies, Frankfurt am Main.

Gross, Daniel (2001b): Trade Flows and the International Business Cycle, *Working Paper* No.2001/12, Center for Financial Studies, Frankfurt am Main.

Helliwell, John F. and Tim Padmore (1985): Empirical Studies of Macroeconomic Interdependence in Jones, R.W. and P.B.Kenen: *Handbook of International Economics* (Vol.2), Elsevier Science Publishers B.V.

International Monetary Fund (2001): International Linkages: Three Perspectives (Chapter III), *World Economic Outlook*, October

Kehoe, Patrick J. (2000): International Business Cycles with Endogenous Incomplete Markets, *NBER Working Paper* No. 7870.

Kenen, Peter B. (1985): Macroeconomic Theory and Policy: How the Closed Economy was Opened? in Jones, R.W. and P.B.Kenen: *Handbook of International Economics* (Vol.2), Elsevier Science Publishers B.V.

Kouparitsas, Michael A. (1996): North-South Business Cycles, *Working Paper,* Federal Bank of Chicago

Kouparitsas, Michael A. (2000): Evidence of the North-South Business Cycles, *Economic Perspectives,* Federal Reserve Bank of Chicago

Kwark, Noh-Sun (1999): Sources of International Business Fluctuations: Country-specific Shocks or Worldwide Shocks? *Journal of International Economics,* Vol 48, pp 367-85.

Kose, M.Ayhan, Christopher Otrok and Charles H.Whiteman (2000): International Busniess Cycles: World, Region and Country-Specific Factors, Paper presented at the Growth and Business Cycle Conference in Manchester.

Lumsdaine, Robin L. and Eswar S. Prasad (1997): Identifying the Common Component in International Economic Fluctuations, *NBER Working Paper* No. 5984

Mall. O.P. (1999): Composite Index of Leading Indicators for Business Cycles in India, *Reserve Bank of India Occasional Papers,* Vol.20, No.3,Winter

Obstfeld, Maurice and Kenneth Rogoff (1995): The Intertemporal Approach to the Current Account, in Grossman, Gene M. and Kenneth Rogoff: *Handbook of International Economics* (Vol.3), Elsevier Science Publishers B.V.

Prasad, Eswar S. (1999): International Trade and the Business Cycle, *Working Paper,* International Monetary Fund, April.

Reserve Bank of India (2001): *Handbook of Statistics on Indian Economy*

Zimmermann, Christian (1995): International Trade over the Business Cycle: Stylised Facts and Remaining Puzzles, *Working Paper,* Research Center on Employment and Economic Fluctuations, Universite du Quebec a Montreal.

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Sustainability of Services-Led Growth: An Input Output Analysis of the Indian Economy

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The sustainability of services as also of services-led growth of the Indian economy has been addressed in terms of the inter-sectoral linkages as emanating from the input-output transactions tables for 1993-94 both at the disaggregated level of 115 activities and the aggregated level of 10 constructed national accounts categories. At the disaggregated level, the Indian economy is found to be predominantly services-intensive with 55 per cent activities direct services-intensive and industry the most services-intensive sector. In the process, industrial activities turn out to be the major pace setter for services-growth. On the other hand, services stand out to have the largest inducing effect on the economy as per the Rasmussen measure of both backward and forward linkages. The backward and forward coefficients of variation indices, however, show that the inducing impulses from services might have worked mainly through the channel of forward linkage. However, since the forward linkage is inherently less effective than the backward linkage, the inducing impact of services on the rest of the economy could be limited. Nevertheless, as per the index of vertical integration, the services sector is found to have the largest expansionary potential (multiplying effect) on the rest of the economy. Therefore, the services-led growth augurs well for the Indian economy for sustaining the overall GDP growth. However, since the multiplier value remains less than one for all the activities including services, the expansionary potential of a services-led growth may not be over emphasised unless accompanied by growth impulses from other sources.

JEL Classification: O14

Key words: Services, Input-Output Analysis

Introduction

The services sector has been the mainstay of the Indian growth process in the 1990s. While the share of services has been ruling high ever since independence, it has received a major fillip only in the 1990s. Indeed, contribution of the services sector to the overall GDP growth peaked an all time high of 65.1 per cent in the 1990s up from 43.6 per cent in the 1980s. As a result, the services share in GDP went up by a spectacular 7.9 per cent in a

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single decade of the 1990s touching the mark of 48.5 per cent in 2000-01 while the sector took about four decades to improve its share by 12.6 per cent to 40.6 per cent in 1990-91 from 28.0 per cent in 1950-51. The ascendancy of services has had a stabilising effect on the growth process itself. To quote from the Reserve Bank's *Report on Currency and Finance*, *2000-01,* ''…it is the services sector which has kept the GDP growth around 6.0 per cent in the 1990s when industry and agriculture sectors did not perform relatively well'' (p. iii – 44). Thus, ''the services sector has been the most dynamic sector of the Indian economy, especially over the last ten years'' (*National Statistical Commission,* 2001, art 7.1.2).[1]

Another notable feature of the 1990s is the emergence of information technology (IT) related services. On this count, India has come to be increasingly recognised as a post-industrial society and as a knowledge-based economy. Such optimism is possibly routed to the recent spurt in software exports and the perceived potential of trade in services such as IT, communications and entertainment. Indeed, in conjunction to the domestic economy, services, hitherto considered non-tradable, have provided a significant source of comfort to the country's balance of payments in the 1990s. The Reserve Bank's *Report on Currency and Finance, 2000-01* has explicitly recognised this development: ''As against a deficit of US $ 0.2 billion in 1990-91 that partly exacerbated the external payments imbalances during that year, the net invisible surplus has grown over time to around US $ 12-13 billion in the recent period, imparting resilience and sustainability to current account deficits and overall balance of payments during the 1990s'' (p.vi -6).

The preponderance of services in the Indian economy, however, runs counter to the conventional wisdom on development at least on two counts (Madheswaran and Dharmadhikary, 2000). The well-known sequence of structural transformation from an agrarian economy to a predominantly service economy *en route* an industrial economy as noticed in the developed world has not been witnessed in India. While the share of agriculture in GDP has registered a secular decline from 57.7 per cent in 1950-51 to 24.2 per cent in 2000-01, the void has not been filled in by industry even though it has

improved its share to 27.3 per cent in 2000-01 from 14.8 per cent in 1950-51. On the other hand, services sector has come to occupy the position of a prime mover in the Indian economy with its share at 48.5 per cent in 2000-01 as against 28.0 per cent in 1950-51. The observed dominance of services ahead of industry with the decline of agriculture has, however, given rise to apprehension as to whether the sequence of the growth process would be reversed in the future particularly when industry is yet to achieve adequate growth. Such apprehension seems to have gained a ground in the absence of preponderance of services in the country's employment. In 1999-00, services have accounted for around 23.5 per cent of total employment in the country. On the other hand, agriculture still continues to account for a major share of employment despite its secular decline in terms of share in GDP. In the developed world, however, rise and dominance of a sector in GDP has been accompanied by its simultaneous ascendancy in employment. The observed counter-factuals in terms of sequence of growth and employment as also the apparent imbalance between the two have been an added concern in the Indian growth process.

The spectacular performance of the services sector in the 1990s has once again raked up the issue of its plausibility and sustainability (Acharya, 2002b). The issue has attracted an added attention in view of the fact that a part of the services growth is reckoned to be 'spurious' as reflecting the revaluation of contribution from public administration and defence in line with the Fifth Pay Commission's recommendations. The impact of such wage hike on GDP has found place even in official documents including the *Economic Survey, 1998-99:* ''…fully one percentage point of growth of 5.0 per cent in GDP for 1997-98 is attributed to the 20 per cent increase in real value added in the 'public administration and defence' sub-sector arising chiefly from pay increases to government servants'' (p.1). Subsequent sobering of the growth performance of the economy seems to have extended credence to such concerns.

Indeed, the high growth momentum of the 1990s seems to have petered out in the new millennium with the growth fatigue finally catching up the services sector. The GDP growth crashed to an abysmal 4.0 per cent in 2000-01, the lowest since 1992-93,

under the weight of the services growth touching the rock bottom of 4.8 per cent, a level witnessed only in the crisis year of 1991-92. Although a modicum of recovery set in during 2001-02 both for the services sector and the GDP, the sudden deceleration of the services sector has brought the question of its sustainability at the centre-stage.

Even in the financial press, the question being hotly debated has been: how long can the services growth remain immune to the happenings in agriculture and industry? For example, S. S. Anklesaria Iyer (2002a; 2002b) in a series of articles in *The Economic Times* has welcomed the rapid growth of services in the 1990s. In his view, 'as the industry-less growth is here to stay, our ability to compensate for industrial failure with services success is a strength, not a weakness'. On the other hand, Acharya (2002a; 2002c) has been sceptical of the idea of services-led growth. In his words, '…India's services sector can't enjoy fast and sustained growth. It can, but only in tandem with a fast growing industrial sector…Services cannot, by themselves, assure rapid and sustained growth of the Indian economy.'

As the Indian economy is currently passing through a phase of industrial slowdown coupled with a cyclical downturn in agriculture, a perceptive view on the services growth assumes prescriptive importance in steering the economy on to the path of recovery. It is against this backdrop, the present study sets out its focus on the sustainability of services growth as also of the overall services-led growth process. Specifically, the study is built around the following quests: what is the services intensity of the various sectors of the economy? How strong are the backward and forward linkages of services with the rest of the sectors? Are the strong backward and forward linkages of services, if any, an outcome of large transactions with a few sectors or an outcome of broad-based transactions with many sectors? What is the expansionary potential of services on non-services in terms of the multiplying effect on the rest of the economy? Which services have the largest multiplier effect on the economy?

The rest of the study is organised as follows. Section I presents a select survey of literature on the role of services in the growth

process with special reference to India. Section II offers a snapshot of the observed relationship between the services and the major macro aggregates including income, consumption, capital and export in the Indian economy. Section III discusses the methodological background and data sources. Section IV presents the empirical findings coupled with their possible interpretations. Section V concludes the study.

Section I

Services Sector and Economic Growth: A Select Survey of Literature

The role of services in the development process is marked by a long controversy. In fact, the debate dates back to Adam Smith who was of the view that services 'perish in the very instant of their performance and seldom leave any trace or value behind them'. As such, services have drawn for themselves a tag of unproductive activity from the classical economists. Until recently, services used to be treated accordingly by the erstwhile socialist or centrally planned economies and classified as 'non-material production' as against the productive 'material production' in their national accounts statistics.

While services have long come out of such categorisation, the debate seems to have shifted its focus to the level of productivity. While Fisher (1935) and Clark (1940) attributed the preponderance of services in the developed world to its level of income, they recognised the low productivity in services as a factor behind the faster employment growth in services than in industry. Fuchs (1965) also came to a similar conclusion for the US economy in the 1960s. Such productivity differentials formed the basis of the well-known 'cost disease' hypothesis of services propounded by Baumol (1967). Higher productivity in industry was visualised to raise wages even in services more than the productivity growth, leading to a chronic tendency for costs and prices of services to increase relative to goods. In view of the post-1973 productivity slowdown in the US, increasing tertiarisation of the US economy has been a cause for concern (Triplett & Bosworth, 2000).

The reported low productivity in services has however been questioned, among others, by Griliches (1992). The low level of services productivity is advocated to be a fall-out of mis-measurement of services output. Besides, factors like technological change, deregulation and increased competition are set to raise productivity at least in select services (Maclean, 1996). Even Baumol *et al* (1985) have recognised the case of 'progressive' services with substantial productivity gains. Besides, the 'asymptotically stagnant' services initially register productivity gains followed by standardisation and stagnation in productivity. Nevertheless, there is now increasing recognition that the very act of service even involves externalities for user or the user's goods in terms of gain in productivity or its potential (Hill, 1977). In fact, such over-bearing feature of services makes the estimation exercise daunting and more so for the newly arrived activity of information technology (IT)-related services as the national statistical systems are largely designed to capture developments only in the goods sector. This has led to a situation of low measured productivity despite increased use of computers and IT, which is otherwise expected to boost the productivity growth. This incongruity is popularly known as the Solow productivity paradox. While several attempts have been made to explain the paradox, the exact role of distortions in official statistics therein remains controversial (Diewert, *et al,* 1999).

Yet another popular scepticism perceives services as innovation laggards and primarily consumers of innovation in manufacturing (Miles, 1993). However, increasingly such a view has come to be questioned in recent period. In contrast to a manufacturing innovation in terms of new or improved product/process, innovation in services often relates to how, where and when a service is delivered (Howells, 2000). Productivity-enhancing investment in ICT (*i.e.,* information and communication technology), regulatory reform and growing tradability of services are among the major factors contributing to innovations in services (Pilat, 2000a).

A logical corollary to the concerns of productivity and innovation has been the view that high growth, be that of services or the service-oriented economies, is not sustainable. The decline in manufacturing and the corresponding shift to services is widely

held to be unsupportable in the long run since services depend critically on manufacturing for their existence. Such well-entrenched notion of parasitic and dependent services has recently come under increasing scrutiny (Bryson and Daniels, 1998). Rather than services following and supporting manufacturing, manufacturing is seen as flowing to those countries and areas where the services infrastructure is efficient and well developed (OECD, 2000). Besides, the increasing resembling of services with commodities has enabled the former to emerge as the major driving force in economic growth. Thus, the conclusion that service economies are naturally sluggish seems to be premature (US Department of Commerce, 1996).

Be that as it may, the growing role of services in national economies is clear and unequivocal particularly for the developed world, which could better be labelled as post-industrial society (Bell, 1967). A variety of explanations are put forward in the literature to explain such an orientation. To begin with, the building block of the Fisher-Clark hypothesis of increasing tertiarisation with increased income has been a variant of the Engel's Law that the income elasticity of demand for services is greater than that of demand for goods. While early empirical works have found support to such hypothesis, recent studies such as Falvey and Gemmell (1996) have tended to reject the income-elastic demand for services overall but confirm a wide range of income elasticity estimates (above and below unity) across different types of services. Indeed, in contrast to a post-industrial society, Gershuny (1978) has even advocated a self-service economy, wherein self-service activities with the help of consumer durables are visualised to replace the purchased consumer services. The increased use of consumer durables is expected to enhance the demand for intermediate services such as servicing and repair of household equipments. The Gershuny effect is found to operate in a number of developed and developing economies including Brazil (Flores, 1995). The thesis has also been questioned both on theoretical and empirical grounds. For example, Silver (1987) has argued that increasing woman participation in workforce reduces the time available for self-service within the household. On the other hand, emergence of a broad-based prosperous middle class coupled with an ageing population is found to boost the demand for consumer services in the Asia (Wirtz, 2001).

The process towards increasing specialisation and vertical disintegration has entailed focusing on core competencies combined with outsourcing of peripheral activities (Stigler, 1956). The externalisation of non-core activities, formerly carried out in-house and counted as industrial output, is believed to be the engine of services growth and, by the same token, decline of industry. Such contracting out renders the firm's cost structure flexible necessitated by a shorter product cycle and changing taste pattern. However, externalisation is found to have only marginally influenced the growth of small business service firms of the UK (Bryson, *et al*, 1993). Yet another accounting explanation of the services growth can be traced to the work of Browne (1986). With the increasing monetisation of the economy, a major chunk of household activities is outsourced from the market. The measured growth of national income is, therefore, biased upward since such shifts in production do not result in a corresponding increase in total output of the combined household and market sectors.

With the increasing complexities of modern industrial organisations, manufacturing activities have become more and more service intensive both upstream (*e.g.*, design and R & D) and downstream (*e.g.*, marketing and advertising) (Pilat, 2000b). Competitive advantage of a firm now depends more on providing specialised services like financing and after-sales facilities than on production, which has increasingly become routinised. On the other hand, new in-house services have come up to extend an interface with the outside provider of services on externalisation of the latter (UNCTAD, 1989, p. 145). All these are arguably reflected in increased demand for intermediate services. In the case of Canada, however, intermediate services have not registered substantial increase (*Economic Council of Canada*, 1991).

The ascendancy of services in the developed world has often been accompanied by deindustrialisation as in the case of the UK. Kaldor (1966) was of the view that a mature economy could continue to benefit from economies of scale 'not through a fast growth in manufacturing industry as a whole, but through greater international specialism … or in other words by increasing the degree of interdependence of British industry with the industries of other

countries' (p. 122). Thus, management and service functions may be located in one country while manufacturing activities in another. Such a process has possibly worked out in rapid industrialisation of the developing world and de-industrialisation of the developed world.

In the Indian context, the increasing share of services in GDP has been a source of controversy ever since independence. Rao (1954) discounted it as an indicator of development in the context of a developing country. Nevertheless, the dominance of services was traced back to factors such as the increasing role of government in economic planning and execution, the historical role of urban middle class in wholesale trade and distribution, and the demonstration effect of high income countries (Panchamukhi, *et al*, 1986). The sustainability of a service-led growth was once again questioned by Shah (1987) and Mitra (1988). Bhattacharya and Mitra (1989; 1990) also felt that the service-led growth could have serious implications for inflation, income distribution and balance of payments since income (employment) might have grown faster than employment (income) in the organised (un-organised) services. Besides, '…income from service sector is growing much in excess of the demand generated for the services by the commodity sector' (p. 2449). However, in view of the similar pattern of growth both in net material product and NDP during 1950-51 to 1983-84, Datta (1989) refuted the view of overgrowth of the services sector. Given the limited role of services in employment generation and absorption, policy intervention was advocated in some circles (Mazumdar, 1995, and Arunachalam and Kumar, 2002). Bhowmik (2000) highlighted the fact that about 50 per cent industries in the Indian economy were direct and direct plus indirect services intensive in 1991-92. Besides, services appeared to be the most growth-inducing and generated a higher value added in other industries than in their own.

Section II

Services Sector in the Indian Growth Process: A Few Stylized Facts

The preponderance of services over industry is not a recent phenomenon for the Indian economy but has been in place since the beginning of 1950s (Table 1). Such predominance of services over industry could be an outcome of the de-industrialisation process pursued in British India (Bagchi, 1982). While the decline of the primary sector, *i.e.*, largely agriculture, is in keeping with the conventional wisdom on development, the preponderance of services ahead of industry stands out as a departure from the past. Nonetheless, the Indian experience is not a standalone case. A number of developing countries such as Zambia, Chad, Sudan, Kenya and Pakistan have also undergone a similar phase in their development process.

Table 1: Agriculture, Industry and Services: Shares in GDP

(Per cent)

Year	Agriculture	Industry	Services
1	2	3	4
1950-51	57.2	14.8	28.0
1960-61	54.7	16.6	28.7
1970-71	48.1	19.9	32.1
1980-81	41.8	21.6	36.6
1990-91	34.9	24.5	40.6
2000-01	24.2	27.3	48.5
2001-02	24.3	26.7	49.0

Source: Central Statistical Organisation.

Moreover, the decline in growth of GDP has in general not been accompanied by a reduction in share of services (Table 2). This observation runs counter to the established theories but is in keeping with the growth experience of the developed world (Chandrasekhar and Ghosh, 2000). The visible hand of the government as reflected in planning and production in the economy as a whole could have contributed to such a development (Mazumdar, 1995).

Table 2: Services and GDP: Growth and Share

(Per cent)

Year	Services Growth	GDP Growth	Services Share
1	2	3	4
1951-52	2.7	2.3	28.1
1960-61	5.9	7.1	28.7
1970-71	4.9	5.0	32.1
1980-81	4.5	7.2	36.6
1990-91	5.3	5.6	40.6
2000-01	4.8	4.0	48.5
2001-02	6.5	5.4	49.0

Source: Central Statistical Organisation.

The services sector entered the decade of 1990s with a growth of 5.3 per cent, even lower than the GDP growth of 5.6 per cent in 1990-91 (Table 3). In the following year of the balance of payments crisis when both agriculture and industry encountered a negative growth, services posted a positive growth of 4.8 per cent, ensuring an overall GDP growth of 1.3 per cent. During the boom phase of 7 per cent plus GDP growth, *i.e.,* from 1994-95 to 1996-97, the growth in services as well ruled over 7 per cent. In the subsequent years till 2001-02, the services growth remained higher than those of the other sectors barring 2000-01 when it crashed to a mere 4.8 per cent primarily gravitated by the negative growth in non-bank financial companies. Overall, the services sector posted a growth of 7.6 per cent in 1990s up from 6.6 per cent in 1980s.

As per the *Economic Survey, 2000-01,* liberalisation of the economy in the 1990s and encouragement of private investment in industry and infrastructure have induced sustained high growth in services sector. A rapid increase in expenditure on public administration and defence, social services, and rural extension services also has an impact on the growth of services sector. Besides, IT software and services has emerged as one of the fastest growing segments of the economy with a compound annual growth of over 50 per cent during 1990s (Rastogi, 2002).

Table 3: Sectoral and Overall GDP Growth Since 1990-91

(Per cent)

Year	Agriculture	Industry	Services	GDP
1	2	3	4	5
1990-91	4.1	7.7	5.3	5.6
1991-92	-0.02	-0.6	4.8	1.3
1992-93	5.8	4.0	5.4	5.1
1993-94	4.1	5.2	7.7	5.9
1994-95	5.0	10.2	7.1	7.3
1995-96	-0.9	11.6	10.5	7.3
1996-97	9.6	7.1	7.2	7.8
1997-98	-2.4	4.3	9.8	4.8
1998-99	6.2	3.4	8.3	6.5
1999-00	1.3	5.3	9.5	6.1
2000-01	-0.2	6.3	4.8	4.0
2001-02	5.7	3.3	6.5	5.4
Memo Item				
1990-00	3.3	5.8	7.6	5.8
1980-90	4.4	6.8	6.6	5.8

Source: Central Statistical Organisation.

In commensurate with the value added, services share in private final consumption expenditure has witnessed a steady increase from 10.2 per cent in 1950-51 to 29.0 per cent in 2000-01 (Hansda, 2002). The share of services export as a per cent of merchandise export has also improved from 13.8 per cent in 1950-51 to 45.1 per cent in 2001-02. On the other hand, the share of services in net fixed capital stock has declined from as high as 68.4 per cent in 1950-51 to 45.3 per cent in 1999-00. Similar trend is observed in its share of gross capital formation (*i.e.,* investment), which has decreased from 57.7 per cent in 1950-51 to 39.6 per cent in 1999-2000. The absorption of labour in services has also not been that encouraging.

While the various sources of growth vent out conflicting signal for services, the sector has come to occupy the dominant position in the Indian economy by the end of 1990s. Probably greater inter-sectoral linkages as reflected in the growing intermediate use of services as against their final use have been the major contributor to the services growth (Table 4). The intermediate use of services output has grown from 31.2 per cent in 1968-69 to 38.5 per cent in 1993-94 when its final use has declined from 68.8 per cent to 61.5 per cent over the same period. The increased intermediate use of services output has taken place in the production of both commodities and services. It is towards such exploration of inter-sectoral linkages, the following section discusses the methodology of the present study.

Table 4: Percentage Distribution of Services Output

Item	Year	Commo-dities	Services	Intermediate Use	Final Use	Total Output
1	2	3	4	5	6	7
Services	1968-69	21.8	9.4	31.2	68.8	100.0
	1973-74	21.2	9.4	30.6	69.4	100.0
	1978-79	23.4	15.5	38.9	61.1	100.0
	1983-84	24.4	13.1	37.5	62.5	100.0
	1989-90	27.8	12.8	40.6	59.4	100.0
	1993-94	26.8	11.7	38.5	61.5	100.0

Source: *Input-Output Transactions Table 1993-94*, CSO (2000).

Section III

Data Base and Methodology

Given the line of inquiry as set out *ab initio,* the empirical quest has been pursued in an input-output framework. For the purpose, CSO's latest Input-Output Transactions Table (IOTT), which pertains to the year 1993-94, has been utilised. As per the IOTT, 1993-94, the economy is disaggregated into 115 activities, of which 22 activities are in agriculture, 80 in industry and 13 in

services. The analysis is carried out both at the level of 115 activities and at the aggregated level. For the later, 115 activities are clubbed into 10 broad categories in line with the sectorisation of national accounts statistics.

The basic input-output relation can be presented in the following matrix notation: $X = AX + F$ (1)

where $X = (x_1, \ldots, x_N)'$ is the vector of gross output; $A = (a_{ij})$ is the matrix of technical input-output coefficients and $F = (f_1, \ldots, f_N)'$ is the vector of final demand. Equation (1) states that gross output, X, is the sum of intermediate demand, AX, and final demand, F. From equation (1), it follows that

$$X = (I - A)^{-1} F \quad (2)$$

if (I – A), known as the Leontief matrix, is non-singular and where I is the identity matrix. The matrix $(I - A)^{-1}$ is known as the Leontief inverse matrix, which represents the direct and indirect requirements of gross output in each line of activity to support one unit of final demand in each line of activity.

As a first approximation of the inter-sectoral linkages, sectoral intensity of an activity is often employed in the literature (*e.g.*, Proops, 1988). While such intensity could be defined in a variety of ways, the popular ones run in terms of output or final demand. Specifically,

GX = Sectoral intensity in relation to output (3)

G^*F = Sectoral intensity in relation to final demand (4)

$$G^* = G (I - A)^{-1} \quad (5)$$

where G is the vector of direct input requirements from a sector (i.e., agriculture, industry or services) to produce one unit of gross output by an activity and G* is the vector of direct and indirect input requirements from a sector to produce one unit of output for final demand.

The widely used measures of inter-sectoral dependence are the backward, forward and total linkage indices *a la* Rasmussen

(1956). Backward linkage of a sector measures the inducement to production in other sectors, which is absorbed as an input to the former. On the other hand, forward linkage of a sector measures the extent to which the sector provides inputs for utilisation by other sectors. The sectors having large total linkage is called the key sectors for the purpose of investment allocation with a view to ensuring a faster industrialisation.

The sum of elements in the i^{th} row of the total requirement matrix $(I - A)^{-1}$ is normally taken to be the measure of forward linkage. Such measure of forward linkage assumes a uniform increase in demand by one unit for all the sectors, which is however unlikely to materialise in practice. Weighting the total requirement matrix by the share in final demand is claimed to avoid the problem (Claus, 2002). Accordingly, each element of $(I - A)^{-1}$, say b_{ij} , is weighted to generate b_{ij}^{w}, the typical element of the final demand weighted Leontief inverse where $b_{ij}^{w} = b_{ij}\ f_i / \Sigma_{i=1}^{N} f_i$

The sum of elements in the i^{th} row of the final demand weighted Leontief inverse, *i.e.*, $b_{i.}^{w} = \Sigma_{j=1}^{N} b_{ij}^{w}$, which is nothing but the forward linkage, shows the increase in output of the i^{th} sector used as inputs for producing an additional unit of final demand output, given each sector's share in total final demand. The inter-industry comparison of forward linkages can be made by constructing an index of the forward linkage as follows:

$$U_{i.}^{w} = (1/N) b_{i.}^{w} / (1/N^2) \Sigma_{i=1}^{N} b_{i.}^{w} \quad (6)$$

The numerator of equation (6) measures the average stimulus to other sectors, according to each sector's share in total demand, resulting from a unit increase in final demand for output of the i^{th} sector. The denominator measures the average stimulus to the entire economy resulting from a unit increase in final demand for output of all sectors.

Similarly, an index of the backward linkage is derived the following way:

$$U_{.j}^{w} = (1/N) b_{.j}^{w} / (1/N^2) \Sigma_{j=1}^{N} b_{.j}^{w} \quad (7)$$

where sum of the elements in the j^{th} column, i.e., $b_{.j}^{w} = \Sigma_{i=1}^{N} b_{ij}^{w}$ stands for the input requirements for a unit increase in the final demand for output of the j^{th} sector given each sector's share in total final demand. Those sectors having each of the indices of backward and forward linkages greater than unity are considered the key sectors of the economy. Alternatively, sectors having the sum of indices of backward and forward linkages, *i.e.*, the total linkage equal to or exceeding the value of 2 may be treated as the key sectors (Anjaneyulu and Prakash, 1994).

The above indices of backward and forward linkages being the averages are sensitive to extreme values. A sector, which buys (sells) large amounts only from (to) a few sectors, may end up having a high backward (forward) linkage index. In order to account for such dispersion in intermediate (final) demand, the linkage indices are supplemented by the following coefficient of variation indices (Rasmussen, 1956):

$$V_{i.}^{w} = [(1/N) \Sigma_{j=1}^{N} \{b_{ij}^{w} - (1/N)\, b_{i.}w\}^{2}]^{1/2} / (1/N)\, b_{i.}w \qquad (8)$$

$$V_{.j}^{w} = [(1/N) \Sigma_{i=1}^{N} \{b_{ij}^{w} - (1/N)\, b_{.j}w\}^{2}]^{1/2} / (1/N)\, b_{.j}w \qquad (9)$$

The numerators in (8) and (9) are the standard deviations and the denominators the averages. The coefficient of variation index, $V_{i.}^{w}$ ($V_{.j}^{w}$) measures the relative evenness with which the i^{th} (j^{th}) industry sells (purchases) to (from) other sectors. A relatively large value of $V_{i.}^{w}$ ($V_{.j}^{w}$) means that the i^{th} sector sells (purchases) output (inputs) to (from) only a few industries in the economy. Obviously, the key sectors with low coefficient of variation index score a point in priority over the sectors with high coefficient of variation index.

The Rasmussen measures of inter-sectoral linkages have been criticised in the literature on a number of grounds. The backward and forward linkages are even shown to be mutually inconsistent, among others, by Cella (1984). Against such a backdrop, Heimler (1991) has put forward an alternative index of vertical integration, which measures the multiplying effect of each activity on the gross output of the rest of the economy.

As we are interested in the multiplying effect of the services sector for the year 1993-94, let us partition the matrix $A = (a_{ij})$ in four sub-matrices:

$$X_n = A_{nn}X_n + A_{ns}X_s + F_n \quad (10)$$

$$X_s = A_{sn}X_n + A_{ss}X_s + F_s \quad (11)$$

where X_n and X_s are the respective vectors of gross output of non-services and services activities, A_{nn} and A_{ss} are the matrices of technical coefficients for self-consumption in non-services and services activities respectively, A_{ns} and A_{sn} are the respective matrices of technical coefficients in respect of use of non-services in services and *vice versa*, and F_n and F_s are the vectors of final demand for non-services and services respectively.

Equations (10) and (11) can be respectively solved for X_n and X_s, treating the other as exogenous:

$$X_n = (I - A_{nn})^{-1}A_{ns}X_s + (I - A_{nn})^{-1}F_n \quad (12)$$

$$X_s = (I - A_{ss})^{-1}A_{sn}X_n + (I - A_{ss})^{-1}F_s \quad (13)$$

The first member of the right hand side of (12) [(13)] represents the direct and indirect effect of gross output of services [non-services] on that of non-services [services]. The latter can be multiplied by a diagonal matrix of value added coefficients (say, va_n) to obtain the value added of non-services (say, VA_n) needed directly and indirectly to produce services gross output:

$$VA_n = va_n\ (I - A_{nn})^{-1}A_{ns}X_s \quad (14)$$

$$VA_s = va_s\ (I - A_{ss})^{-1}A_{sn}X_n \quad (15)$$

where value added coefficient refers to value added divided by production activity-wise.

The expansionary potential of services on non-services and, in turn, on services can be gauged by constructing an index of vertical integration the following way:

$$Int_s = VA_n / TVA_s \quad (16)$$

$$Int_n = VA_s / TVA_s$$

where TVA_s stands for total value added of services. The index Int measures the indirect effect of services on non-services and, in turn, on services, providing a dimension free measure of the multiplier of each on the value added of the rest of the economy. The activity for which Int is the highest can be ranked as the key sector of the economy in terms of its ability to generate value added in other activities.

Section IV

Empirical Findings

Sectoral Intensity

The sectoral intensity of activities provides a ready-reckoner of the inter-sectoral linkages between agriculture, industry and services. While the details on sectoral intensity for all the 115 activities are presented in Appendix Table 1, Table 5 reports the summary observations. As per the direct measure of intensity (G), 34 out of 115 activities or 30 per cent activities have had the agricultural intensity above the average of 7 per cent of gross output. The sector of agriculture itself has turned out to be the most agriculture-intensive sector with 68 per cent of agricultural activities having the agriculture intensity above the average as against 23 per cent and 8 per cent of industrial and services activities respectively. Only one out of 13 services activities, *viz.*, hotels and restaurants has the agricultural intensity above the average. This implies that services activities hardly draw their inputs from agriculture while such linkage is relatively strong between industry and agriculture. In terms of variation in intensities, range in agricultural intensity has been higher than that of services intensity but less than that of industrial intensity. The picture has remained more or less the same in terms of the direct and indirect measure of intensity (G*).

Table 5: Distribution of Activities with Above Average Sectoral Intensity

(No. of Activities)

Item	Agriculture Intensive		Industry Intensive		Services Intensive	
	G	G*	G	G*	G	G*
1	2	3	4	5	6	7
1. Agricultural Activity	15 (68)	15 (68)	0 (0)	0 (0)	1 (5)	1 (5)
2. Industrial Activity	18 (23)	22 (28)	57 (71)	55 (69)	56 (70)	59 (74)
3. Services Activity	1 (8)	1 (8)	3 (23)	3 (23)	6 (46)	2 (15)
4. Total (1+2+3)	34 (30)	38 (33)	60 (52)	58 (50)	63 (55)	62 (54)
Memo Items#						
Average Intensity	7	12	29	59	15	30
Minimum to Maximum Intensity Range	0 to 74	0 to 88	0 to 76	-14 to 154	0 to 41	0 to 68

Figures in bracket are percentage share in the respective sectoral total of activities. G: Direct intensity; G*: Direct plus indirect intensity; #: As percent to gross output.

In terms of the direct measure of intensity (G), 60 out of 115 activities or 52 per cent activities have reported higher than the average industrial intensity of 29 per cent of gross output. Notably, not a single agricultural activity has the above average industrial intensity. The industrial sector with 57 out of 80 industrial activities or 71 per cent of its activities has been the most industry intensive when only 3 services activities out of 13, *viz.*, medical and health, railway transport services, and other transport services, have the above average industry intensity. In other words, neither agricultural nor services activities seem to be much dependent on industry for input. However, the industrial intensity of the economy stands out to be of high order with 50 per cent of the total number of activities displaying the above average industrial intensity even in terms of

the direct and indirect measure of intensity (G*). The extent of variation in industrial intensity has been the most, possibly reflecting wide variation in technology at the activity level. Besides, the industrial intensity has turned out even negative for the activity of rubber production while the same has been more than 100 per cent for 17 industrial activities in terms of the direct and indirect measure of intensity (G*).

With 63 out of 115 activities or 55 per cent activities having the above average services intensity, the predominance of services intensive activities is clear in the economy. Interestingly, unlike agriculture and industry, services sector *per se* is not the most services intensive sector. It is the industrial sector, which has turned out to be relatively services intensive in its 56 out of 80 industrial activities (*i.e.*, 70 per cent industrial activities). On the other hand, 6 out of 13 services activities, *i.e.*, 46 per cent services activities have had the services intensity above the average of 15 per cent of gross output. Only one agricultural activity, *viz.*, animal services (agricultural) has the above average services intensity. As per the direct and indirect measure of services intensity (G*), the number of industrial activities with the above average services intensity has gone up to 59 (*i.e.*, 74 per cent of industrial activities) while that of services activities has declined to 2 with the overall number of activities down to 62 from 63. The average services intensity has also doubled to 30 per cent of gross output while the upper limit of variation in services intensity has increased to 68 per cent of gross output for ships and boats from 41 per cent for office computing machines. Three industrial activities, *viz.*, office computing machines, ships and boats, and coal tar products stand out the most services intensive in terms of both direct, and direct and indirect measures of services intensity. On the other hand, public administration and ownership of dwellings have the lowest services intensity under both the definitions of services intensity. The average level of services intensity has been higher than that of agricultural intensity but stands lower than that of industrial intensity. The range of variation in services intensity turns out to be the lowest among all types of sectoral intensity. On the whole, the majority of activities and more so of the industrial activities turn out to be relatively services-intensive in the Indian economy.

At the aggregate level of 10 categories, three categories, *viz.*, allied activities, agriculture and manufacturing, in terms of direct measure, and four categories, *viz.*, the former three and construction, in terms of direct and indirect measure of intensity, have turned out to be relatively agriculture-intensive (Table 6). None of the aggregate categories of services are agriculture-intensive. Similarly for the industrial intensity, three industrial categories, *viz.*, electricity, gas & water supply; manufacturing and construction, and one services category, *viz.*, transport, storage and communication have had the industrial intensity above the average both in terms of direct, and direct and indirect measures of industrial intensity. Both the agricultural categories - agriculture and allied activities – are found to be not industry-intensive. On the other hand, industry has turned out to be more services-intensive than services. Three industrial categories out of four, *viz.*, manufacturing, construction, and electricity, gas and water supply, and two services categories out of four, *viz.*, transport, storage & communication, and trade, hotels & restaurants are found to be services-intensive in terms of direct measure of intensity. In terms of direct and indirect measure however, only one services category - transport, storage & communication – has the services intensity above the average. No agricultural category has been services-intensive. Thus, in keeping with the activity-wise trend, services and industry are found, at the aggregate level, more inter-dependent than services and agricultural sectors. Nonetheless, dominance of the services sector is clear even at the aggregate level.

Backward and Forward Linkages

As per the Rasmussen index of backward linkage accounting for both direct and indirect linkages, 46 out of the total of 115 activities (i.e., 40 per cent) – seven out of 22 agricultural activities (*i.e.*, 32 per cent), 31 out of 80 industrial activities (*i.e.*, 39 per cent) and eight out of 13 services activities (*i.e.*, 62 per cent) – have had relatively large index value (Appendix Table 2). Clearly, the services activities have the largest inducing effect on the rest in terms of backward linkage. Activity-wise, construction from industry, trade and other transport services from services, and animal services (agricultural) and other crops from agriculture have had large backward index value in that order. The index value of backward

linkage has varied between –0.23 for crude petroleum & natural gas and 4.59 for construction.

Similarly, in terms of the index of forward linkage, 15 out of the total of 115 activities (*i.e.*, 13 per cent) – 5 out of 22 agricultural activities (*i.e.*, 23 per cent), 3 out of 80 industrial activities (*i.e.*, 4 per cent) and 7 out of 13 services activities (*i.e.*, 54 per cent) – have reported high forward linkage index. Once again, the services activities are endowed with relatively large forward linkage. Activity-wise, forward linkage effects of trade and other transport services from services, other crops from agriculture, construction from industry and other services from services have been relatively high in that order. The index value of forward linkage has varied between -2.43 for crude petroleum & natural gas and 37.95 for trade.

Even in terms of the total of backward and forward linkage indices, a larger proportion of activities in services (69 per cent) than in industry (8 per cent) or agriculture (27 per cent) stand out to be the key sectors of the economy with the total index value higher than two. The top five activities in terms of the total index value are trade and other transport services from services, construction from industry, other crops from agriculture, and other services from services. Clearly, the first four activities are the ones having high backward as well as forward linkage. In total, 21 out of 115 activities (*i.e.*, 18 per cent) can be termed as the key sectors of the economy with the total index value greater than two.

At the aggregate level, manufacturing, construction, agriculture, personal, social & other services; and transport, storage & communication are the key sectors in terms of the backward linkage (Table 7). On the other hand, only manufacturing and agriculture are the key sectors of the economy in terms of the forward linkage. Clearly, the high linkage of services at the activity level seems to have been overshadowed by aggregation.

Table 6: Sectoral Intensity – Aggregate Categories

Sector	Ga	Rank	G*a	Rank	Gi	Rank	G*i	Rank	Gs	Rank	G*s	Rank
1	2	3	4	5	6	7	8	9	10	11	12	13
Agriculture	0.131	2	0.172	3	0.092	7	0.211	8	0.057	10	0.122	8
Allied activities	0.179	1	0.220	1	0.039	10	0.127	9	0.068	8	0.121	9
Mining & quarrying	0.000	9	0.028	9	0.190	5	0.358	5	0.070	7	0.152	7
Manufacturing	0.091	3	0.179	2	0.420	2	0.811	1	0.185	2	0.385	1
Construction	0.024	5	0.095	4	0.362	3	0.706	3	0.202	1	0.381	2
Electricity, gas & water supply	0.004	8	0.038	8	0.453	1	0.800	2	0.166	4	0.330	3
Transport, storage & communication	0.023	6	0.074	5	0.282	4	0.560	4	0.175	3	0.317	4
Trade, hotels & restaurants	0.034	4	0.060	6	0.091	8	0.214	7	0.160	5	0.227	5
Financing, insurance & real estate	0.000	10	0.006	10	0.044	9	0.089	10	0.061	9	0.087	10
Personal, social & other services	0.016	7	0.048	7	0.152	6	0.301	6	0.090	6	0.167	6
Average Intensity	0.050		0.092		0.212		0.418		0.123		0.229	

G: Direct sectoral intensity; G*: Direct and indirect sectoral intensity; a: agriculture; i: industry; s: services.

Table 7: Backward & Forward Linkage Indices – Aggregate Categories

Sector		B. Index	Rank	F. Index	Rank
	1	2	3	4	5
1	Agriculture	1.26	3	1.54	2
2	Allied activities	0.81	7	0.53	7
3	Mining & quarrying	0.26	10	-0.18	10
4	Manufacturing	2.24	1	4.32	1
5	Construction	1.46	2	0.67	5
6	Electricity, gas & water supply	0.48	8	0.07	9
7	Transport, storage & communication	1.03	5	0.64	6
8	Trade, hotels & restaurants	0.90	6	0.98	3
9	Financing, insurance & real estate	0.45	9	0.50	8
10	Personal, social & other services	1.11	4	0.92	4
Average Index		1		1	

B: Backward Linkage; F: Forward Linkage.

Dispersal of Backward and Forward Linkages

In order to take into account the variation in the index of linkage, both the backward and forward coefficient of variation indices have been calculated (Appendix Table 3). A relatively large value of such indices implies that a sector purchases (sells) inputs only from (to) a few sectors in the economy. As per the backward coefficient of variation index, 5 out of 13 services activities (*i.e.*, 38 per cent), 45 out of 80 industrial activities (*i.e.*, 56 per cent) and 12 out of 22 agricultural activities (*i.e.*, 55 per cent) have their index value below the average of 5.50 per cent. The low proportion of services activities with low backward coefficient of variation in contrast to the high proportion of services activities with high backward linkage implies that the strong backward linkage of the majority of services owes to the large inter-sectoral purchases from only a few sectors rather than widespread purchases from many different activities. Notably, all the five top performers in terms of the backward linkage index have as well a high backward coefficient of variation index.

However, in terms of the forward coefficient of variation index, seven out of 13 services activities (*i.e.,* 54 per cent) as against 27 out of 80 industrial activities (*i.e,* 34 per cent) and eight out of 22 agricultural activities (*i.e.,* 36 per cent) have the index value below the average of 6.91 per cent. Thus, high proportion of services activities with high forward linkage is also accompanied by high proportion of services activities with low forward coefficient of variation. In other words, the strong forward linkage of the majority of services owes to the widespread sale to many different activities. Interestingly, the five top performers in terms of the forward linkage have also a low forward coefficient of variation. Thus, the inducing impulses from the services sector appear to have worked mainly through the channel of forward linkage with the rest of the economy.

At the aggregate level, mining & quarrying, manufacturing; transport, storage & communication; agriculture; trade, hotels & restaurants, and personal, social & other services have low backward coefficient of variation (Table 8). Therefore, the sectors identified with high backward linkage seem to be purchasing inputs from a wide spectrum of sectors as reflected in the low backward coefficient of variation. Construction turns out to be the only exception. The majority of services sectors have a low backward coefficient of variation at the aggregate level in contrast to the trend obtained at the activity level. On the other hand, transport, storage & communication; electricity, gas & water supply; construction, allied activities, trade, hotels & restaurants; personal, social & other services have low forward coefficient of variation index. In other words, the sectors with high forward linkage are found to have high forward coefficient of variation index, *i.e.,* selling inputs to only a few sectors. Thus, the trend at the aggregate level differs from the activity level both in terms of linkage index and coefficient of variation index.

Table 8: Backward & Forward Coefficient of Variation Indices: Aggregate Categories

	Sector	$V_{i.}^{w}$	Rank	$V_{.j}^{w}$	Rank
	1	2	3	4	5
1	Agriculture	1.85	4	2.35	8
2	Allied activities	3.13	8	1.68	4
3	Mining & quarrying	-4.71	1	3.47	10
4	Manufacturing	1.09	2	2.53	9
5	Construction	2.64	7	1.59	3
6	Electricity, gas & water supply	10.42	10	1.57	2
7	Transport, storage & communication	1.76	3	1.55	1
8	Trade, hotels & restaurants	1.88	5	1.93	5
9	Financing, insurance & real estate	3.40	9	2.34	7
10	Personal, social & other services	2.32	6	1.99	6
	Average Index	2.38		2.10	

$V_{i.}^{w}$ and $V_{.j}^{w}$ are respectively the forward and the backward coefficient of variation indices.

Vertical Integration

In order to provide a dimension-free measure of the multiplier of each sector on the value added of the rest of the economy, the index of vertical integration has been calculated activity-wise (Appendix Table 3). 14 out of the 115 activities having the index value higher than the average are reported in Table 9. Out of the 14 activities, 7 activities belong to services, followed by 6 from industry and 1 from agriculture. The top 3 activities in terms of the index value turn out to be trade, banking and other transport services, all belonging to the services sector. Indeed, out of the total of 13 services activities, as many as 7 have large multiplier effect on the rest of the economy. On the other hand, out of the total of 80 industrial activities, only 6 provide a strong stimulus on the rest of the economy whereas only one activity out of the total of 22 agricultural activities, *viz.*, other crops, does so. Clearly, services sector stands out to be more growth inducing than industry or agriculture. However, the multiplier value remains less than one for all the 115 activities, implying that the value added indirectly induced is less than the direct value added by each. Further, the activities – animal services (agricultural)

from agriculture, mica from industry, and ownership of dwellings and public administration from services – appear to have no inducing effect on the rest of the economy. Only one activity – plastic products from industry – indicates a possible negative impact. Notably, the top five performers in terms of the total of backward and forward linkages, *viz.*, trade, other transport services and other services from the services sector, construction from industry, and other crops from agriculture are also found to have relatively high stimulus for the rest of the economy in terms of the index of vertical integration.

Table 9: Activities with Index of Vertical Integration Above the Average

Activity	**Index**	**Sector**	**Rank**
1	2	3	4
Trade	0.118427	Services	1
Banking	0.053505	Services	2
Other transport services	0.046273	Services	3
Crude petroleum, natural gas	0.026344	Industry	4
Other services	0.023001	Services	5
Electricity	0.018460	Industry	6
Railway transport services	0.016679	Services	7
Other crops	0.014095	Agriculture	8
Communication	0.011990	Services	9
Insurance	0.011414	Services	10
Construction	0.010982	Industry	11
Coal & lignite	0.008537	Industry	12
Miscellaneous manufacturing	0.007211	Industry	13
Drugs & medicines	0.004917	Industry	14
Average Index	0.003878		

At the aggregate level of 10 categories, three categories from services, *viz.*, trade, hotels & restaurants; transport, storage & communication; and financing, insurance & real estate, and one category from industry, *viz.*, manufacturing have the index value

above the average, indicating a clear dominance of services in terms of the multiplying effect on the rest of the economy *vis-à-vis* industry or agriculture (Table 10). In contrast to the position at the activity level, the stimulus of construction on the rest of the economy turns out the smallest at the aggregate level. Interestingly, manufacturing has been the single common category in terms of the backward/forward linkages as well as the index of vertical integration.

Table 10: Index of Vertical Integration – Aggregate Categories

	Sector	**Index**	**Rank**
	1	2	3
1	Agriculture	0.034825	5
2	Allied activities	0.012048	9
3	Mining & quarrying	0.023378	7
4	Manufacturing	0.062276	4
5	Construction	0.010932	10
6	Electricity, gas & water supply	0.020909	8
7	Transport, storage & communication	0.073804	2
8	Trade, hotels & restaurants	0.113444	1
9	Financing, insurance & real estate	0.063660	3
10	Personal, social & other services	0.032675	6
	Average Index	0.044795	

Section V

Concluding Observations

The growth of services as also the services-led growth of the Indian economy has been addressed in the study from the angle of sustainability. For the purpose, the study has primarily focused upon the inter-sectoral linkages as emanating from the input-output transactions tables for 1993-94 both at the aggregated level of 10 constructed national accounts categories and the most disaggregated level of 115 activities. While the aggregative analysis presents a variation from the disaggregated one, the Indian economy is found to be predominantly services-intensive at the disaggregated level with 55 per cent (54 per cent) activities direct (direct and indirect) services-intensive. The average services intensity stands doubled to 30 per cent of gross output with the switchover to direct and indirect services-intensity from direct services-intensity. The range of variation in services-intensity turns out the lowest among the three types of sectoral intensity defined in the study. While services and agriculture do not seem to share much inter-dependence, industry is observed to be the most services-intensive with 70 per cent (74 per cent) of its activities being direct (direct and indirect) services-intensive. While 46 per cent (15 per cent) of services activities stand out services-intensive, 23 per cent (23 per cent) of services activities report industry-intensive. Thus, while the industrial activities seem to be predominantly permeated with the services content, by the same token, they turn out to be the major pace setter for services-growth. In other words, sustained services-growth requires a growing industry too.

The inter-sectoral linkages are explored further in terms of the popular Rasmussen indices of backward and forward linkages as also their variation. Once again, 62 per cent (54 per cent) of services activities as against 39 per cent (4 per cent) of industrial activities and 32 per cent (23 per cent) of agricultural activities report strong inducing effect on the economy in terms of the backward (forward) linkage. The top 5 key sectors in terms of the total of backward and forward linkage indices turn out to be trade, other transport services and other services, construction and other crops. The strong backward linkage of services is found to be attributable

to the large inter-sectoral purchases from only a few sectors. In contrast, the strong forward linkage of services is accompanied by widespread sales to many different activities. Thus, the inducing impulses from services might have worked mainly through the channel of forward linkage. However, since the forward linkage is inherently less effective than the backward linkage, the inducing impact of services on the rest of the economy could be limited.

Finally, the expansionary potential of services on non-services and services, in turn, has been examined by computing the index of vertical integration, which provides a dimension-free measure of the multiplier of each activity on the value added of the rest of the economy. Seven, six and one respectively out of 13 services, 80 industrial and 22 agricultural activities are found to have the largest expansionary potential. The top three activities in terms of the index value turn out to be trade, banking and other transport services, all belonging to the services sector. Further, the top five performers in terms of the total of backward and forward linkages are also found to have a relatively high index value of vertical integration. Clearly, the services sector stands out more growth inducing than industry or agriculture. Therefore, for sustaining the overall growth process, the services-led growth augurs well for the Indian economy in so far as the growth impulses originate in services *vis-à-vis* industry or agriculture. However, since the value added indirectly induced on the rest of the economy falls short of the direct value added by each activity including from services, the expansionary potential of services-led growth may not be over-emphasised unless accompanied by growth impulses from other sources.

Notes:

[1]Contrary to the popular view, Nagaraj (2000) however holds that ''since the secondary sector growth rate has modestly slowed, the tertiary sector has become the fastest growing sector in the 1990s – but not because its growth rate has improved in that decade, statistically significantly'' (p 2833).

References

Acharya, S. (2002a), 'Growth Prospects Dim', *The Economic Times,* January 3.

– (2002b), 'Macroeconomic Management in the Nineties', *Economic and Political Weekly,* 37 (16), April 20, 1515-1538.

– (2002c), 'Services Not the Real Saviour', *The Economic Times,* September 9.

Aiyar, S. S. Anklesaria (2002a), 'Stuck in the 5-6 Per Cent Groove', *The Economic Times,* August 7.

– (2002b), 'Is Industryless Growth Here to Stay?', *The Economic Times,* August 21.

Anjaneyulu, D. and Prakash, Ajay (1994), 'Inter-Temporal Comparison of Inter-Industrial Linkages in the Indian Economy (1968-69 to 1983-84)', *Reserve Bank of India Occasional Papers,* 15 (1), March, 1-30.

Arunachalam, R. and Kumar, K. N. (2002), 'Dynamics of Services Sector in India: An Overview', 1-12, in Gandhi, P. J. and Ganesan, P. (ed.) (2002), *Services Sector in the Indian Economy,* Deep and Deep Publications Private Ltd., New Delhi.

Bagchi, A. K. (1982), *The Political Economy of Underdevelopment,* Cambridge.

Baumol, W. J. (1967), 'Macroeconomics of Unbalanced Growth: the Anatomy of an Urban Crisis', *American Economic Review,* 57, 415-426, June.

Baumol, W. J., Blackman, S. A. B., and Wolff, E. N. (1985), 'Unbalanced Growth Revisited: Asymptotic Stagnancy and the New Evidence', *American Economic Review,* 75, September.

Bell, D. (1967), 'Notes on the Post-Industrial Society (I)', *Public Interest,* 6, Winter, 24-35.

Bhattacharya, B. B. and Mitra, A. (1989), 'Industry-Agriculture Growth Rates: Widening Disparity: An Explanation', *Economic and Political Weekly,* August 26.

– (1990), 'Excess Growth of Tertiary Sector in Indian Economy: Issues and Implications', *Economic and Political Weekly,* November 3, 2445-2450.

Bhowmik, R. (2000), 'Role of Services Sector in Indian Economy: An Input-Output Approach', *Artha Vijnana,* XLII (2), June, 158-169.

Browne, L. E. (1986), 'Taking in Each Other's Laundry – The Service Economy', *The New England Economic Review,* July/August.

Bryson, J. R. and Daniels, P. W. (1998), 'Introduction: Understanding the Rise and Role of Service Activities and Employment in the Global Economy: An

Introduction to the Academic Literature', in Bryson, J. R. and Daniels, P. W. (edited) (1998), *Service Industries in the Global Economy,* vol. I, Edward Elgar Publishing Ltd: Cheltenham, UK.

Bryson, J. R., Keeble, D., and Wood, P. (1993), 'The Creation, Location and Growth of Small Business Service Firms in the United Kingdom', *Service Industries Journal,* 13 (2), 118-131.

Cella, G. (1984), 'The Input-Output Measurement of Inter-industry Linkages', *Oxford Bulletin of Economics and Statistics,* 46, February, 73-84.

Central Statistical Organisation (2000), *Input-Output Transactions Table 1993-94,* Ministry of Statistics and Programme Implementation, Government of India, New Delhi.

Chandrasekhar, C. P. and J. Ghosh (2000), 'Services Sector Growth: What does it mean?', *Hindu Business Line.*

Clark, C. (1940), *The Conditions of Economic Progress,* London: Macmillan.

Claus, Iris (2002), 'Inter Industry Linkages in New Zealand', Working Paper 02/09, June, New Zealand Treasury.

Datta, M. (1989), 'Tertiary Sector and Net Material Product: Indian Economy, 1950-51 to 1983-84', *Economic and Political Weekly,* September 23.

Diewert, E. W., Nakamura, A. and Sharpe, A. (ed.) (1999), 'Special Issue on Service Sector Productivity and the Productivity Paradox', *Canadian Journal of Economics,* 32 (2), April.

Economic Council of Canada (1991), *Employment in the Service Sector,* Ministry of Supply and Services, Ottawa, Canada.

Falvey, R. and Gemmell, N. (1996), 'Are Services Income-Elastic? Some New Evidence', *Review of Income and Wealth,* 42 (3), September.

Fisher, A. G. B. (1935), *The Clash of Progress and Security,* London: Macmillan.

Flores, R. G. Jr. (1995), 'Three Hypotheses on the Brazilian Service Sector', *Review of Income and Wealth,* 41 (2), June.

Fuchs, V. R. (1965), 'The Growing Importance of the Service Industries', *Journal of Business,* 38, 344-373.

Gershuny, J. (1978), *After Industrial Society: The Emerging Self-Service Economy?,* London: Macmillan.

Griliches, Z. (ed.) (1992), *Output Measurement in the Service Sectors,* National Bureau of Economic Research, Studies in Income and Wealth, Vol. 56, University of Chicago Press, Chicago.

Hansda, Sanjay K. (2002), 'Services Sector in the Indian Economy: A Status Report', *RBI Staff Studies*, S. S. (DEAP): 1/2002, September, Mumbai.

Heimler, A. (1991), 'Linkages and Vertical Integration in the Chinese Economy', *The Review of Economics and Statistics*, 73, May, 261-267.

Hill, T. P. (1977), 'On Goods and Services', *Review of Income and Wealth*, 23 (4), 315-338, December.

Howells, J. (2000), 'The Nature of Innovation in Services', Report Presented to the OECD/Australia Workshop on Innovation and Productivity in Services, 31 October – 3 November, Sydney, Australia.

Kaldor, N. (1966), *Causes for the Slow Rate of Growth of the United Kingdom*, Cambridge: Cambridge University Press.

Maclean, D. (1996), 'Productivity Growth in the Commercial Service Sector', *Bank of Canada Review*, autumn.

Madheswaran, S. and Dharmadhikary, A. (2000), 'Income and Employment Growth in Service Sector in India', *The Indian Journal of Labour Economics*, 43 (4), 835-864.

Mazumdar, Krishna (1995), 'Disproportional Growth of Service Sector in India: 1960-1990', *The Indian Economic Journal*, 43 (2), October-December.

Miles, I. (1993), 'Services in the New Industrial Economy', *Futures*, 25, 653-672.

Mitra, Ashok (1988), 'Disproportionality and the Services Sector: A Note', *Social Scientist*, April, 3-8.

Nagaraj, R. (2000), 'Indian Economy since 1980: Virtuous Growth or Polarisation?', *Economic and Political Weekly*, August 5, 2831-2838.

OECD (2000), A Report on Business & Industry Policy Forum, Paris.

Panchamukhi, V. R., Nambiar, R. G. and Mehta, R. (1986), 'Structural Change and Economic Growth in Developing Countries', VIII Work Economic Congress of International Economic Association, December.

Pilat, D. (2000a), 'Innovation and Productivity in Services: State of the Art', Paper Prepared for the OECD/Australia Workshop on Innovation and Productivity in Services, 31 October – 3 November, Sydney, Australia.

– (2000b), 'No Longer Services As Usual', *OECD Observer*, November 23.

Proops, J. L. R. (1988), 'Energy Intensities, Input-Output Analysis and Economic Development', in Ciaschini, M. (edited), *Input-Output Analysis*, London: Chapman and Hall Ltd.

Rao, V. K. R. V. (1954), 'Changes in India's National Income – A Static Economy in Progress', *Capital*, December 16.

Rasmussen, P. N. (1956), *Studies in Intersectoral Relations,* Amsterdam, North Holland.

Rastogi, R. (2002),'Indian Information Technology Sector – An Overview', paper presented at a *Seminar on Preparation of an Index of Services Production,* January 3-4, Organised at Pune by Union Ministry of Finance, Indian Association for Research in National Income & Wealth and National Institute of Bank Management.

Shah, M. (1987), 'India's Dream: A Five Per Cent Rate of Growth', in Brahmananda, P. R. and Panchamukhi, V. R. (edited), *The Development Process of the Indian Economy,* Bombay: Himalaya Publishing House.

Silver, H. (1987), 'Only So Many Hours a Day: Time Constraints, Labor Pools, and Demand for Consumer Services', *The Service Industries Journal,* 7 (4), 26-45.

Stigler, G. J. (1956), *Trends in Employment in the Service Industries,* National Bureau of Economic Research, Princeton University Press, Princeton.

Triplett, J. and Bosworth, B. (2000), 'Productivity in the Services Sector', The Brookings Institution, Washington DC, US.

UNCTAD (1989), *Services in the World Economy,* Trade and Development Report.

US Department of Commerce (1996), *Service Industries and Economic Performance,* Economics and Statistics Administration, Office of Policy Development, March.

Wirtz, J. (2001), 'Growth of the Service Sector in Asia', *Singapore Management Review.*

Appendix Table 1: Sectoral Intensity - Sector and Activity-wise

	Activity	Ga	Rank	G*a	Rank	Gi	Rank	G*i	Rank	Gs	Rank	G*s	Rank
1		2	3	4	5	6	7	8	9	10	11	12	13
	Agriculture												
1	Paddy	19.8	14	28.3	12	11.3	80	31.9	79	7.8	86	18.3	80
2	Wheat	15.3	19	21.3	18	17.4	73	43.8	67	7.2	88	19.1	77
3	Jowar	11.9	25	20.8	19	6.6	93	19.1	92	6.4	89	14.0	90
4	Bajra	11.8	26	20.1	21	8.1	91	21.8	87	6.3	90	14.1	89
5	Maize	12.3	24	19.9	23	8.9	88	23.4	85	6.1	92	14.2	88
6	Gram	11.7	27	16.3	30	5.1	103	13.7	100	3.7	106	8.4	104
7	Pulses	22.4	11	33.6	9	10.5	83	29.5	82	8.0	83	19.0	78
8	Sugarcane	6.7	35	8.6	43	5.4	102	12.9	101	3.6	109	7.3	109
9	Groundnut	16.8	17	25.5	15	8.4	90	24.1	84	6.2	91	14.9	87
10	Jute	8.9	31	13.6	32	1.8	112	6.6	111	3.4	110	6.9	111
11	Cotton	7.7	34	11.9	37	9.1	87	22.3	86	4.6	100	11.0	96
12	Tea	5.8	38	7.4	44	1.7	113	5.2	113	2.8	111	4.9	113
13	Coffee	14.6	20	18.9	24	4.1	108	12.5	102	5.4	96	10.3	98
14	Rubber	0.0	105	0.4	113	6.2	96	14.0	99	2.0	113	5.1	112
15	Coconut	5.4	39	6.9	45	4.9	106	12.4	103	3.8	105	7.4	108
16	Tobacco	4.0	42	6.5	47	6.2	98	14.7	96	3.6	108	7.9	107
17	Other crops	9.5	30	14.1	31	6.6	94	17.7	94	4.3	102	10.1	99
18	Milk & milk products	14.0	21	17.5	27	2.4	111	7.5	110	5.3	97	8.8	101
19	Animal services (agricultural)	73.7	1	88.2	1	4.6	107	26.1	83	21.4	17	35.6	53
20	Other livestock products	21.4	13	27.0	13	3.3	109	11.1	105	7.3	87	12.5	94
21	Forestry & logging	0.5	61	1.0	105	5.0	105	11.1	106	4.2	103	7.2	110
22	Fishing	2.0	48	3.3	64	9.4	86	19.0	93	3.9	104	9.4	100
	Industry												
23	Coal & lignite	0.0	104	2.1	84	26.0	65	50.8	64	9.4	80	20.8	76
24	Crude petroleum, natural gas	0.0	103	0.7	110	10.1	85	20.3	91	3.7	107	8.5	102
25	Iron ore	0.0	102	1.9	88	20.5	67	41.4	69	8.0	82	16.6	84
26	Manganese ore	0.0	108	0.9	106	5.1	104	10.8	107	5.5	95	8.3	105
27	Bauxite	0.0	110	0.9	107	6.2	95	17.4	95	10.1	79	15.3	85
28	Copper ore	0.0	111	1.9	87	20.2	68	40.7	70	7.8	85	16.6	83
29	Other metallic minerals	0.0	112	1.7	94	18.6	70	36.3	73	4.9	99	12.8	92
30	Lime stone	0.0	113	1.8	91	18.0	71	35.1	75	5.7	94	13.3	91

1		2	3	4	5	6	7	8	9	10	11	12	13
31	Mica	0.0	114	5.6	50	28.9	60	58.1	59	13.3	69	25.3	71
32	Other non-metallic minerals	0.0	99	1.4	101	7.2	92	14.7	97	4.5	101	8.2	106
33	Sugar	53.4	3	59.2	5	6.2	97	21.7	88	18.2	39	28.3	66
34	Khandsari, boora	52.0	4	61.1	3	11.0	81	31.0	81	16.5	51	28.6	65
35	Hydrogenated oil (vanaspati)	40.2	6	58.1	6	29.4	59	62.3	55	18.5	35	37.5	47
36	Edible oils other than vanaspati	57.0	2	73.2	2	10.8	82	34.8	76	11.4	76	25.7	70
37	Tea & coffee processing	29.5	8	36.6	8	12.0	79	36.2	74	33.9	4	50.6	7
38	Miscellaneous food products	45.7	5	60.5	4	15.6	76	38.5	72	17.8	43	32.8	59
39	Beverages	9.7	29	17.2	29	28.1	61	55.0	63	19.5	28	34.8	57
40	Tobacco products	18.9	15	23.1	17	16.9	74	42.6	68	22.7	11	36.7	48
41	Khadi, cotton textiles (handlooms)	1.8	50	10.3	40	33.4	52	60.0	58	12.0	74	29.6	63
42	Cotton textiles	25.4	9	32.8	10	21.4	66	55.8	62	27.6	7	46.6	12
43	Woolen textiles	8.1	33	18.0	26	40.6	43	78.2	44	22.2	13	45.0	15
44	Silk textiles	12.3	23	20.1	22	27.2	62	57.2	60	18.9	33	35.9	51
45	Art silk, synthetic fiber textiles	3.3	44	9.5	42	48.2	20	100.1	17	20.3	23	45.7	14
46	Jute, hemp, mesta textiles	18.2	16	24.0	16	17.5	72	47.8	66	32.3	5	49.5	8
47	Carpet weaving	5.1	40	12.2	35	31.0	56	62.0	56	19.3	30	37.7	46
48	Readymade garments	1.3	54	11.8	38	45.7	33	85.9	38	18.5	36	43.6	20
49	Miscellaneous textile products	4.8	41	13.3	34	40.3	45	78.9	43	21.5	16	44.4	16
50	Furniture & fixtures-wooden	15.5	18	18.8	25	20.1	69	39.1	71	12.2	72	22.3	75
51	Wood & wood products	23.2	10	26.1	14	14.8	77	31.7	80	13.3	68	22.9	74
52	Paper, paper prods. & newsprint	6.5	36	12.1	36	46.7	27	94.0	32	20.5	21	43.9	18
53	Printing & publishing	0.2	66	5.0	55	40.7	42	83.9	40	15.8	58	36.5	49
54	Leather footwear	6.0	37	13.5	33	34.3	51	64.6	53	22.4	12	41.7	28
55	Leather & leather products	10.5	28	20.1	20	38.5	47	77.7	46	23.3	10	47.4	11
56	Rubber products	8.3	32	10.3	39	43.2	38	-14.3	115	21.4	19	12.1	95
57	Plastic products	0.3	62	4.1	60	50.0	15	100.7	16	10.4	78	30.7	61
58	Petroleum products	0.1	68	1.5	100	75.6	1	96.6	26	8.9	81	18.6	79
59	Coal tar products	0.1	71	3.2	65	53.9	8	95.3	29	39.6	3	60.6	3

1		2	3	4	5	6	7	8	9	10	11	12	13
60	Inorganic heavy chemicals	1.6	53	4.6	58	43.0	39	83.9	41	19.0	32	38.3	41
61	Organic heavy chemicals	1.7	51	5.6	51	48.6	19	94.9	31	16.7	49	37.8	42
62	Fertilizers	0.2	65	4.5	59	60.0	4	108.4	10	18.0	40	40.1	33
63	Pesticides	0.0	76	5.5	52	59.0	5	122.4	4	15.7	59	42.7	24
64	Paints, varnishes & lacquers	0.6	59	5.0	54	48.8	18	96.4	27	16.6	50	38.5	40
65	Drugs & medicines	1.7	52	6.4	48	44.4	37	89.4	35	20.5	20	43.0	22
66	Soaps, cosmetics & glycerin	3.0	45	9.9	41	50.2	14	99.5	18	16.1	55	39.5	37
67	Synthetic fibers, resin	1.1	56	5.1	53	49.6	16	97.4	22	14.3	66	35.1	55
68	Other chemicals	22.0	12	31.0	11	36.7	49	76.1	47	19.0	31	39.6	36
69	Structural clay products	1.1	55	3.2	66	40.6	44	68.6	50	21.4	18	35.8	52
70	Cement	0.1	74	2.4	73	46.7	26	84.2	39	24.4	8	42.7	23
71	Other non-metallic mineral prods.	0.3	63	2.3	77	40.0	46	72.6	49	20.1	25	35.4	54
72	Iron, steel & ferro alloys	0.0	83	1.6	96	53.7	9	113.1	6	21.5	15	49.1	9
73	Iron and steel casting & forging	0.1	75	1.9	89	60.9	3	129.0	3	16.8	48	47.5	10
74	Iron & steel foundries	0.0	84	1.8	93	62.1	2	136.6	2	17.8	42	50.7	6
75	Non-ferrous basic metals	0.0	85	2.2	81	56.6	7	113.9	5	14.3	65	37.8	43
76	Hand tools, hardware	0.1	73	1.9	86	42.6	40	92.7	34	17.5	45	39.5	39
77	Miscellaneous metal products	0.1	70	1.9	90	51.6	11	112.3	7	16.4	52	42.2	27
78	Tractors and agri. implements	0.0	80	2.2	82	51.0	13	109.6	9	16.2	53	41.2	30
79	Industrial machinery (F&T)	0.0	77	2.3	80	51.5	12	111.5	8	17.3	47	42.7	25
80	Industrial machinery (others)	0.0	79	2.7	70	45.1	35	103.0	14	28.7	6	56.1	4
81	Machine tools	0.0	82	2.0	85	47.2	23	102.6	15	15.6	60	39.8	35
82	Office computing machines	0.0	81	3.0	68	32.1	54	67.6	52	41.1	1	61.0	2
83	Other non-electrical machinery	0.0	86	1.8	92	44.7	36	96.8	24	17.6	44	40.5	32
84	Electrical industrial machinery	0.0	89	2.3	75	46.2	28	103.1	13	19.6	26	43.8	19
85	Electrical wires & cables	0.0	97	3.9	62	58.0	6	154.2	1	12.6	71	53.6	5
86	Batteries	0.1	69	3.1	67	52.1	10	106.9	11	14.2	67	36.4	50

1		2	3	4	5	6	7	8	9	10	11	12	13
87	Electrical appliances	0.0	78	2.3	78	45.3	34	96.7	25	18.2	37	40.0	34
88	Communication equipments	0.0	87	2.3	76	45.7	31	96.2	28	15.9	56	37.7	44
89	Other electrical machinery	0.1	72	2.9	69	45.7	32	97.9	21	19.6	27	42.4	26
90	Electronic equip-ments (incl. TV)	0.0	98	2.5	72	49.1	17	104.1	12	17.9	41	41.6	29
91	Ships & boats	0.0	93	3.8	63	32.7	53	83.3	42	41.0	2	67.6	1
92	Rail equipments	0.0	95	1.6	97	45.7	29	95.1	30	7.8	84	27.6	68
93	Motor vehicles	0.0	91	2.4	74	46.9	25	97.3	23	20.3	22	43.6	21
94	Motor cycles & scooters	0.0	94	2.1	83	47.8	22	98.3	19	18.2	38	40.8	31
95	Bicycles, cycle-rickshaw	0.0	88	2.3	79	48.0	21	98.3	20	21.8	14	46.5	13
96	Other transport equipments	0.6	60	2.6	71	45.7	30	92.8	33	10.8	77	30.1	62
97	Watches & clocks	0.0	92	1.7	95	36.7	48	77.7	45	23.8	9	44.3	17
98	Miscellaneous manufacturing	1.8	49	4.9	57	42.3	41	86.8	36	14.6	63	33.9	58
99	Construction	2.4	47	4.9	56	36.2	50	75.6	48	20.2	24	39.5	38
100	Electricity	0.1	67	1.6	98	47.0	24	86.6	37	17.4	46	35.0	56
101	Gas	13.5	22	17.4	28	1.1	114	6.2	112	12.1	73	16.6	82
102	Water supply	0.0	90	1.2	104	26.8	64	48.6	65	2.6	112	12.7	93
	Services												
103	Railway transport services	0.0	96	1.2	103	30.3	57	62.6	54	14.7	62	28.3	67
104	Other transport services	3.0	46	5.7	49	30.0	58	61.1	57	19.4	29	32.5	60
105	Storage & warehousing	0.0	107	0.8	109	15.9	75	33.6	77	15.9	57	24.8	72
106	Communication	0.0	109	0.5	111	10.2	84	20.7	90	6.0	93	10.9	97
107	Trade	0.2	64	1.6	99	8.4	89	21.1	89	16.2	54	23.1	73
108	Hotels & restaurants	30.8	7	43.1	7	14.5	78	32.4	78	14.3	64	26.8	69
109	Banking	0.0	106	0.5	112	3.0	110	7.8	109	11.8	75	15.0	86
110	Insurance	0.0	100	0.9	108	5.5	100	14.1	98	13.2	70	17.9	81
111	Ownership of dwellings	0.0	101	0.3	114	5.5	99	9.7	108	0.0	114	2.2	114
112	Education and research	0.7	58	1.4	102	5.5	101	12.2	104	5.0	98	8.5	103
113	Medical & health	1.1	57	4.0	61	31.6	55	67.9	51	18.9	34	37.7	45
114	Other services	3.7	43	6.7	46	27.2	63	56.4	61	15.0	61	29.2	64
115	Public administration	0.0	115	0.0	115	0.0	115	0.0	114	0.0	115	0.0	115
	Average Sectoral Intensity	7.4	–	11.6	–	28.8	–	59.4	–	14.6	–	29.6	–

Appendix Table 2: Backward, Forward & Total Linkages – Activity-wise Indices

Activity		Backward Index	Rank	Forward Index	Rank	Total Index	Overall Rank
1		2	3	4	5	6	7
Agriculture							
1	Paddy	2.42	6	2.41	7	4.83	6
2	Wheat	1.47	19	1.18	14	2.65	15
3	Jowar	0.63	81	0.14	53	0.76	76
4	Bajra	0.54	88	0.06	70	0.60	89
5	Maize	0.57	86	0.11	57	0.68	82
6	Gram	0.40	97	0.16	47	0.56	90
7	Pulses	1.01	44	0.34	34	1.36	41
8	Sugarcane	0.52	91	0.64	24	1.15	47
9	Groundnut	0.53	89	0.13	55	0.67	84
10	Jute	0.25	107	0.01	87	0.26	107
11	Cotton	0.36	100	0.05	71	0.41	101
12	Tea	0.17	111	0.01	88	0.19	111
13	Coffee	0.46	93	0.03	81	0.49	94
14	Rubber	0.10	113	0.00	104	0.10	113
15	Coconut	0.33	102	0.14	49	0.47	97
16	Tobacco	0.22	108	0.00	93	0.22	110
17	Other crops	2.53	5	11.26	3	13.79	4
18	Milk & milk products	2.03	9	2.03	8	4.07	7
19	Animal services (agricultural)	2.60	4	0.00	102	2.60	16
20	Other livestock products	1.50	18	1.74	11	3.24	12
21	Forestry & logging	0.50	92	0.57	26	1.07	54
22	Fishing	0.58	85	0.41	28	1.00	60
Industry							
23	Coal & lignite	0.44	94	0.03	77	0.48	95
24	Crude petroleum, natural gas	-0.23	115	-2.43	115	-2.66	115
25	Iron ore	0.36	99	0.02	84	0.38	103
26	Manganese ore	0.13	112	0.00	96	0.13	112
27	Bauxite	0.25	106	0.00	98	0.25	108
28	Copper ore	0.34	101	0.00	94	0.34	104
29	Other metallic minerals	0.32	103	0.00	100	0.32	105
30	Lime stone	0.41	96	0.01	91	0.42	100
31	Mica	0.55	87	0.00	101	0.55	92

	1	2	3	4	5	6	7
32	Other non-metallic minerals	-0.12	114	-0.68	114	-0.81	114
33	Sugar	1.19	32	0.39	30	1.58	30
34	Khandsari, boora	1.39	23	0.04	74	1.43	37
35	Hydrogenated oil (vanaspati)	1.80	12	0.07	63	1.87	24
36	Edible oils other than vanaspati	1.32	26	0.39	29	1.71	28
37	Tea & coffee processing	1.34	25	0.22	43	1.55	32
38	Miscellaneous food products	2.38	7	0.96	17	3.34	11
39	Beverages	1.04	41	0.15	48	1.19	46
40	Tobacco products	1.07	39	0.32	36	1.38	40
41	Khadi, cotton textiles (handlooms)	0.97	50	0.14	51	1.11	52
42	Cotton textiles	1.78	13	1.68	13	3.46	9
43	Woolen textiles	1.19	31	0.06	69	1.25	44
44	Silk textiles	0.98	47	0.03	80	1.02	56
45	Art silk, synthetic fiber textiles	1.55	16	0.74	21	2.28	20
46	Jute, hemp, mesta textiles	1.12	36	0.01	89	1.13	50
47	Carpet weaving	0.95	53	0.03	83	0.97	63
48	Readymade garments	1.53	17	0.32	35	1.85	26
49	Miscellaneous textile products	1.23	28	0.19	45	1.42	38
50	Furniture & fixtures-wooden	0.61	84	0.06	65	0.68	83
51	Wood & wood products	0.62	82	0.06	67	0.68	81
52	Paper, paper prods. & newsprint	1.02	43	-0.02	105	1.00	57
53	Printing & publishing	0.98	49	0.23	42	1.21	45
54	Leather footwear	1.16	33	0.14	52	1.29	43
55	Leather & leather products	1.40	21	0.13	54	1.54	33
56	Rubber products	0.28	105	0.23	41	0.51	93
57	Plastic products	0.87	63	0.05	72	0.91	67
58	Petroleum products	0.19	110	0.21	44	0.40	102
59	Coal tar products	0.94	55	-0.11	109	0.83	74
60	Inorganic heavy chemicals	0.74	75	-0.14	110	0.61	88

	1	2	3	4	5	6	7
61	Organic heavy chemicals	0.73	76	-0.25	112	0.47	96
62	Fertilizers	0.75	74	-0.20	111	0.55	91
63	Pesticides	0.98	48	0.01	92	0.99	61
64	Paints, varnishes & lacquers	0.88	61	0.04	73	0.92	66
65	Drugs & medicines	1.20	30	0.36	32	1.56	31
66	Soaps, cosmetics & glycerin	1.24	27	0.28	38	1.53	34
67	Synthetic fibers, resin	0.75	73	-0.05	107	0.70	80
68	Other chemicals	1.47	20	0.29	37	1.75	27
69	Structural clay products	0.66	79	0.00	97	0.66	85
70	Cement	0.83	67	0.01	86	0.84	72
71	Other non-metallic mineral prods.	0.85	66	0.28	39	1.13	49
72	Iron, steel & ferro alloys	1.01	45	0.48	27	1.49	35
73	Iron and steel casting & forging	0.89	58	0.01	90	0.91	68
74	Iron & steel foundries	0.93	56	-0.08	108	0.85	71
75	Non-ferrous basic metals	0.70	78	-0.27	113	0.43	99
76	Hand tools, hardware	0.79	71	0.07	64	0.86	70
77	Miscellaneous metal products	1.11	37	0.77	19	1.88	22
78	Tractors and agri. implements	0.96	51	0.13	56	1.09	53
79	Industrial machinery (F&T)	0.91	57	0.07	62	0.99	62
80	Industrial machinery (others)	1.00	46	0.07	61	1.07	55
81	Machine tools	0.82	68	0.06	66	0.88	69
82	Office computing machines	0.76	72	0.00	95	0.76	77
83	Other non-electrical machinery	1.15	34	0.73	22	1.88	23
84	Electrical industrial machinery	1.03	42	0.37	31	1.40	39
85	Electrical wires & cables	1.40	22	0.08	60	1.48	36
86	Batteries	0.80	70	0.03	78	0.84	73
87	Electrical appliances	0.87	62	0.10	59	0.97	64
88	Communication equipments	0.86	65	0.14	50	1.00	58

	1	2	3	4	5	6	7
89	Other electrical machinery	0.81	69	-0.02	106	0.78	75
90	Electronic equipments (incl. TV)	1.06	40	0.26	40	1.32	42
91	Ships & boats	1.12	35	0.03	79	1.15	48
92	Rail equipments	0.61	83	0.02	85	0.63	87
93	Motor vehicles	1.22	29	0.63	25	1.86	25
94	Motor cycles & scooters	0.95	52	0.17	46	1.12	51
95	Bicycles, cycle-rickshaw	0.89	59	0.10	58	1.00	59
96	Other transport equipments	0.64	80	0.00	103	0.64	86
97	Watches & clocks	0.71	77	0.04	75	0.75	78
98	Miscellaneous manufacturing	1.10	38	0.98	16	2.08	21
99	Construction	4.59	1	10.31	4	14.91	3
100	Electricity	0.86	64	1.86	10	2.72	14
101	Gas	0.42	95	0.04	76	0.45	98
102	Water supply	0.89	60	0.06	68	0.95	65
Services							
103	Railway transport services	0.94	54	0.76	20	1.71	29
104	Other transport services	2.62	3	18.01	2	20.63	2
105	Storage & warehousing	0.29	104	0.00	99	0.29	106
106	Communication	0.40	98	0.34	33	0.75	79
107	Trade	3.55	2	37.95	1	41.50	1
108	Hotels & restaurants	1.80	11	0.73	23	2.53	18
109	Banking	0.52	90	2.45	6	2.98	13
110	Insurance	0.20	109	0.03	82	0.23	109
111	Ownership of dwellings	2.13	8	1.87	9	4.00	8
112	Education and research	1.39	24	1.17	15	2.55	17
113	Medical & health	1.56	15	0.80	18	2.36	19
114	Other services	1.82	10	6.19	5	8.01	5
115	Public administration	1.73	14	1.73	12	3.45	10

Appendix Table 3: Indices of Backward & Forward Coefficient of Variation and Index of Vertical Integration - Activity-wise

Activity		IBCV	Rank	IFCV	Rank	IVI	Rank
1		2	3	4	5	6	7
Agriculture							
1	Paddy	8.52	106	8.48	57	0.002962	21
2	Wheat	7.24	99	8.73	63	0.001613	30
3	Jowar	4.67	10	10.52	103	0.000027	105
4	Bajra	4.72	12	10.51	102	0.000028	103
5	Maize	4.57	8	10.38	98	0.000058	98
6	Gram	4.91	23	9.26	71	0.001462	32
7	Pulses	4.76	16	10.02	85	0.000575	51
8	Sugarcane	6.96	95	6.32	38	0.000813	45
9	Groundnut	4.83	20	6.61	41	0.000948	43
10	Jute	4.91	24	8.55	59	0.000211	74
11	Cotton	4.75	15	6.14	37	0.002102	25
12	Tea	4.74	13	8.54	58	0.000333	63
13	Coffee	4.43	6	10.36	96	0.000030	101
14	Rubber	6.95	94	-9.15	2	0.000891	44
15	Coconut	5.33	52	10.14	88	0.000096	90
16	Tobacco	5.17	44	9.58	76	0.000165	77
17	Other crops	9.53	111	2.79	21	0.014095	8
18	Milk & milk products	8.12	104	8.10	49	0.003336	17
19	Animal services (agricultural)	7.21	98	5.77	34	0.000000	113
20	Other livestock products	6.16	83	4.80	28	0.003135	20
21	Forestry & logging	6.55	91	5.57	32	0.002909	22
22	Fishing	7.25	100	10.00	84	0.000429	59
Industry							
23	Coal & lignite	4.74	14	2.57	20	0.008537	12
24	Crude petroleum, natural gas	-22.17	2	-2.53	13	0.026344	4
25	Iron ore	4.97	31	9.37	74	0.000237	72
26	Manganese ore	4.84	21	10.32	93	0.000068	96
27	Bauxite	4.98	33	10.43	99	0.000038	100
28	Copper ore	4.93	28	10.16	89	0.000082	93
29	Other metallic minerals	4.67	11	8.68	62	0.000402	60
30	Lime stone	4.95	30	9.89	82	0.000117	85
31	Mica	5.54	64	10.68	112	0.000000	111

	1	2	3	4	5	6	7
32	Other non-metallic minerals	-28.16	1	-4.94	8	0.003196	19
33	Sugar	5.45	61	9.72	78	0.000149	79
34	Khandsari, boora	5.64	71	10.05	87	0.000029	102
35	Hydrogenated oil (vanaspati)	5.79	74	10.61	108	0.000016	109
36	Edible oils other than vanaspati	4.93	29	8.37	56	0.000242	71
37	Tea & coffee processing	5.75	73	10.35	95	0.000284	66
38	Miscellaneous food products	4.76	17	9.38	75	0.000329	64
39	Beverages	4.59	9	10.49	101	0.000163	78
40	Tobacco products	4.79	18	10.65	109	0.000027	104
41	Khadi, cotton textiles (handlooms)	4.97	32	9.26	72	0.000105	87
42	Cotton textiles	5.56	67	4.82	29	0.001136	39
43	Woolen textiles	4.79	19	9.07	68	0.000112	86
44	Silk textiles	4.91	25	10.17	90	0.000077	95
45	Art silk, synthetic fiber textiles	5.28	49	7.56	46	0.000595	50
46	Jute, hemp, mesta textiles	6.08	81	8.26	53	0.000270	67
47	Carpet weaving	5.12	42	10.66	111	0.000003	110
48	Readymade garments	4.85	22	10.44	100	0.000079	94
49	Miscellaneous textile products	4.98	34	7.39	44	0.000488	57
50	Furniture & fixtures-wooden	5.04	37	9.87	81	0.000671	46
51	Wood & wood products	5.02	36	5.70	33	0.002137	24
52	Paper, paper prods. & newsprint	5.82	75	-4.68	9	0.002614	23
53	Printing & publishing	5.13	43	8.67	61	0.001888	29
54	Leather footwear	5.61	70	10.59	106	0.000027	106
55	Leather & leather products	6.17	84	9.03	67	0.000174	75
56	Rubber products	11.87	114	6.42	39	0.002096	26
57	Plastic products	5.19	45	62.02	115	-0.001281	115
58	Petroleum products	24.39	115	3.08	23	0.003640	16
59	Coal tar products	6.91	93	-6.30	5	0.000099	88
60	Inorganic heavy chemicals	6.69	92	-4.31	11	0.001162	38

	1	2	3	4	5	6	7
61	Organic heavy chemicals	7.09	97	-4.38	10	0.001387	34
62	Fertilizers	7.81	103	-5.10	7	0.000498	55
63	Pesticides	6.18	85	8.20	51	0.000123	83
64	Paints, varnishes & lacquers	6.2	87	6.50	40	0.000551	53
65	Drugs & medicines	5.4	57	7.66	47	0.004917	14
66	Soaps, cosmetics & glycerin	5.11	40	9.81	79	0.000084	92
67	Synthetic fibers, resin	6.33	88	-5.35	6	0.001171	37
68	Other chemicals	5.37	56	3.04	22	0.001496	31
69	Structural clay products	6.52	90	9.71	77	0.000302	65
70	Cement	6.07	80	8.78	64	0.000490	56
71	Other non-metallic mineral prods.	5.36	54	8.17	50	0.000391	61
72	Iron, steel & ferro alloys	5.85	76	2.32	19	0.003663	15
73	Iron and steel casting & forging	5.88	77	5.99	36	0.000368	62
74	Iron & steel foundries	6.33	89	-6.34	4	0.000574	52
75	Non-ferrous basic metals	7.08	96	-3.42	12	0.001927	28
76	Hand tools, hardware	5.55	66	6.74	42	0.001269	35
77	Miscellaneous metal products	5.25	47	4.60	27	0.001262	36
78	Tractors and agri. Implements	4.99	35	10.04	86	0.000054	99
79	Industrial machinery (F&T)	5.56	68	9.21	69	0.000137	82
80	Industrial machinery (others)	4.91	26	8.20	52	0.000256	68
81	Machine tools	5.31	51	9.31	73	0.000223	73
82	Office computing machines	5.05	39	10.56	105	0.000022	107
83	Other non-electrical machinery	5.36	55	5.95	35	0.001060	42
84	Electrical industrial machinery	5.11	41	7.20	43	0.000479	58
85	Electrical wires & cables	5.57	69	8.27	54	0.000524	54
86	Batteries	6.19	86	10.36	97	0.000149	80
87	Electrical appliances	5.42	60	8.91	65	0.000251	70
88	Communication equipments	5.41	58	9.02	66	0.000660	48

	1	2	3	4	5	6	7
89	Other electrical machinery	5.95	78	-7.75	3	0.000255	69
90	Electronic equipments (incl. TV)	5.34	53	9.83	80	0.000094	91
91	Ships & boats	5.45	62	10.25	91	0.000067	97
92	Rail equipments	6.08	82	7.42	45	0.003270	18
93	Motor vehicles	5.21	46	7.86	48	0.002010	27
94	Motor cycles & scooters	5.27	48	10.31	92	0.000121	84
95	Bicycles, cycle-rickshaw	5.7	72	10.34	94	0.000145	81
96	Other transport equipments	5.97	79	-10.06	1	0.000612	49
97	Watches & clocks	5.04	38	10.66	110	0.000018	108
98	Miscellaneous manufacturing	5.41	59	4.53	26	0.007211	13
99	Construction	8.89	108	3.94	25	0.010982	11
100	Electricity	5.54	65	1.47	16	0.018460	6
101	Gas	4.31	4	10.60	107	0.000173	76
102	Water supply	7.33	101	9.24	70	0.001435	33
Services							
103	Railway transport services	4.92	27	3.22	24	0.016679	7
104	Other transport services	8.58	107	1.29	15	0.046273	3
105	Storage & warehousing	4.42	5	9.96	83	0.000667	47
106	Communication	5.28	50	4.90	30	0.011990	9
107	Trade	9.83	112	0.98	14	0.118427	1
108	Hotels & restaurants	4.43	7	8.27	55	0.001113	40
109	Banking	8.19	105	1.77	17	0.053505	2
110	Insurance	4.04	3	5.00	31	0.011414	10
111	Ownership of dwellings	9.45	110	10.68	114	0.000000	112
112	Education and research	8.92	109	10.55	104	0.000098	89
113	Medical & health	5.53	63	8.59	60	0.001060	41
114	Other services	7.34	102	2.21	18	0.023001	5
115	Public administration	10.68	113	10.68	113	0.000000	114
Average Index		**5.50**		**6.91**		**0.003878**	

IBCV: Index of Backward Coefficient of Variation; IFCV: Index of Forward Coefficient of Variation; and IVI: Index of Vertical Integration.

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Public Sector Spending and Economic Growth in India

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The paper analyses the dynamic interaction between the public sector expenditure and national income in India for the period 1960-61 to 1996-97. It finds a stable long-run relationship between public sector expenditure and national income in India, with the causality running strictly from the former to the latter. The study also indicates that long-run positive impact of public sector expenditure on national income would turn adverse if the growth of the former is excessive. In the short-run, however, there is a trade-off between growth in public sector expenditure and income. Thus, though national income growth in India seems to be investment or demand led, there is the need for maintaining a proper balance between public sector expenditure and investment for economic growth.

JEL Classification: C220, E620, H500

Key words: Public Expenditure, National Income, Economic Growth

Introduction

In the economic literature, there are two propositions on the relationship between public sector expenditure and national income. Wagner's 'law of increasing state activity', owing to German political economist Adolph Wagner (1835-1917), hypothesises that as the economic activity grows, there is a tendency for the government activities to increase. Keynesian macroeconomic models, on the other hand, treat government spending as an exogenous policy instrument that cause changes in aggregate real output.

During the post World War II period, with governments in the Western economies seeking to control the economy, there was a rise in the share of public sector in the national income. This spawned interest in the long-term trends in public expenditures and the causes of its growth in the 1960s, and increasing attention was paid in testifying Wagner's law. On the other hand, the reverse Keynesian pattern of public sector expenditure facilitating economic

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growth has been somewhat underplayed. In the latter, it is important to note that while a moderate rise in public sector expenditure leads to growth in national income, its excessive growth could be detrimental to economic growth due to its crowding out effect.

The present study empirically tests whether the causality between public sector expenditure and national income in India runs in terms of Wagner's hypothesis or in the Keynesian fashion. This is tested on six alternative models, which have their own interpretations and implications. A comparative analysis between them help in drawing a number of inferences. Thus, besides the test for applicability of the two hypotheses in the Indian context, the paper also attempts to draw various inferences on the dynamic interaction between public sector expenditure and national income. In addition, a third variable, namely total investment, is considered for explaining growth in national income in each of the six models.

The remaining part of the paper has the following sections. Section I is a brief review of the empirical tests on the relationship between government spending and national income in the literature in order to draw an analytical framework of the paper. An overview of the data and the method of estimation are briefly explained in section II. The formal investigation and the empirical results are presented in section III. Section IV contains the concluding remarks.

Section I

A Brief Review of Empirical Estimates for Analytical Framework

Most of the empirical estimates on the relationship between public sector expenditure and national income in the literature have been done with a view to offer exposition of Wagner's law. Initially, the investigations into the relationship were on analysing the time pattern of covariance between some measure of government sector growth and the rate of economic growth (Peacock and Wiseman (1961), Musgrave (1969), Gupta (1967) and Pryor (1968)). Towards the end of the 1970s till the mid-1990s, with the advent of causality analysis, the focus shifted to discerning the patterns of causal

links between public expenditure and economic growth. Some of these studies are Mann (1980), Murthy (1993), Ram (1986, 1987), Abizadeh and Gray (1985), Singh and Sahni (1984), Murthy (1993), Ganti and Kolluri (1979), Vatter and Walker (1986), Kyzyzaniak (1974), Pluta (1979) and Gyles (1991).

Peacock and Scott (2000), however, point out that the law does not necessarily imply causation between the two macroeconomic variables since Wagner implied only regularities or empirically observed uniformity in the pattern of growth of government expenditure and the national income. They opine that these latter articles seem to be more concerned vying with one another in the sophistication of testing procedures rather than their purport to offer exposition of the 'law'. Furthermore, even if rising share of public sector expenditure in national income is validated during a given period, the process cannot continue forever since there should be a limit to this share.

As the law itself is open to various interpretations, there is no precise, but six broad categories of models defining the relationship. In all the six, some variant of the measure of national income explains alternate measures of public sector expenditure. The causation, however, could be in the reverse directions in each of these six models, which are:

$$LTE = f(LY) \quad \text{(I)}$$

$$LCE = f(LY) \quad \text{(II)}$$

$$LTE = f(LYN) \quad \text{(III)}$$

$$LTEY = f(LYN) \quad \text{(IV)}$$

$$LTEN = f(LYN) \quad \text{(V)}$$

$$LTEY = f(LY) \quad \text{(VI)}$$

where LTE is the logarithm of real total government expenditure, LCE is the logarithm of real government consumption expenditure, LY is the logarithm of real gross domestic product, LYN is the logarithm of the per capita gross domestic product, LTEY is the logarithm of the ratio of real total government expenditure to real gross domestic product and LTEN is the logarithm of the per capita

real total government expenditure. In models (I) to (VI), f' is expected to be > 0.

Total public sector expenditure as a function of national income in model I above was adopted by Peacock-Wiseman (1961) and Musgrave (1969) to testify the law. In Pryor (1968), Wagner's law holds when consumption component of public sector expenditure increase with the rise in national income (model II). Gofman (1968) and Mann (1980) define the law as increase in total public sector expenditure due to rise in per capita national income (model III). Musgrave (1969), Murthy (1993) and Ram (1987) tested the law in terms of model IV, by which, growth in per capita national income leads to rise in the share of total public sector expenditure in national income. In Gupta (1967), model V, *i.e.*, per capita total public sector expenditure rising with per capita national income, was tested for validity of the law. Mann (1980) also considered rise in the share of total public sector expenditure in the national income as a result of growth in national income (model VI), as validating the law.

The above studies and many others adopting either one or more of the six models have been both cross-country and country-specific covering different time periods. The results, however, have been mixed. Ram (1986) for 63 countries covering the period 1950 to 1980 find limited support to public sector expenditure rising with growth in national income. On the other hand, Abizadeh and Gray (1985) for 55 countries covering a shorter period (1963 to 1979) find general support to rise in the share of public sector in national income in the case of wealthier countries but not for the poorest countries.

Country specific studies include Gupta (1967), Singh and Sahni (1984) and Ram (1986) for Canada, Mann (1980) and Murthy (1993) for Mexico, Ganti and Kolluri (1979) and Vatter and Walker (1986) for the United States, Kyzyzaniak (1974) for Turkey, Pluta (1979) for Taiwan, and Gyles (1991) for the United Kingdom. Majority of these studies provide support to rising share of public sector expenditure with the growth of national income. Peacock and Wiseman (1961), Musgrave (1969, 1988), Michas (1975), Mann

(1980), Ram (1987) and Courakis *et al* (1993) have also provided support to the evidence. Hondroyiannis and Papapetrou (1995) using Johansen's cointegration analysis find no evidence of any long-run relationship between public sector expenditure and national income in Mexico.

The major drawbacks in the above studies are that the empirical tests in many of them are carried out without testing the properties of time series data for stationarity thereby lending suspicion to possible cases of spurious regression. Secondly, they are mostly bivariate models whose estimates may be biased. It is also important to note that a positive relation in any one of the models does not necessarily imply a similar positive relation in the other. For example, when growth in national income leads to increase in total public sector expenditure, it does not necessarily imply that the share of public sector expenditure in national income would also rise *i.e.*, when there is a positive relationship in model I, the relationship in model VI need not necessarily be positive. In fact, the causation in model VI can be negative such that, as the national income grows, the share of public sector expenditure in national income declines. Thus, the validity of the law for a country during given a period of time would depend upon the type of model tested.

Further, in the above studies, the reverse directions of causation are hardly emphasised. In the case of reverse causation, the simultaneous estimation of the six models and interpretation of the results can help in drawing number of inferences. For instances, they allow comparison of the differential impact of rise in public sector consumption expenditure and total expenditure (including investment) on national income. Similarly, a comparison between the impact of absolute increase and relative increase in public sector expenditure on growth of national income can be made in the sense that while increase in public sector expenditure *per se* may lead to growth in national income, a more than proportionate increase may have an adverse impact. In other words, even though public sector expenditure leads to growth in national income, excessive growth by way of rise in its share in national income can dampen income growth by crowding out private investment.

Besides public sector expenditure, inclusion of other important macroeconomic variables determining national income in the model also assumes crucial importance, otherwise the estimated relationships may be biased. Both monetary and debt policies have been found to influence the pattern of causality between growth of public expenditure and growth of national income (see for examples, Ahsan, Kwan and Sahni (1992) for USA and Jha and Seth (1995) for India.

In the Indian context there are two studies which deal with the exposition of the Wagner law. Upender (1995) for the period 1970-71 to 1991-92 finds the elasticity of public sector expenditure to national income to be more than one. In other words, the share of public sector expenditure in national income rose during 1970-71 to 1991-92. The shortcoming of this study is that it is a bivariate model and the estimation is made through simple OLS regression without verifying the nature of the time series data *i.e.*, whether they are stationary or not. Therefore, it does not resolve the problem of spurious regression and biased estimate.

The second study, by Jha and Seth (1995), employed Granger's testing procedure for the period 1951 to 1989 by transforming the data series to stationary time series using Box-Jenkins method. Both bivariate and trivariate models using monetary policy instruments, with M_1 as the variable, are tried out. The findings are as follows: in the bivariate case, causality runs from real gross domestic product to real government expenditure and in per capita terms, causal link runs from per capita real government expenditure to per capita real gross domestic product; in trivariate models with money supply growth included, the pattern of causality alters from the bivariate models and money supply growth and per capita government expenditure have positive effects on output growth.

In the present study, the direction of long-run relationship in the Indian context for each of the six models is first ascertained *i.e.,* whether Wagner's law holds or Keynesian hypothesis predominates. The appropriate long-run relationships and short-run dynamics in an error correction framework are then estimated in order to draw inferences, alternatively with and without total investment as the third variable for each of the models.

Section II
Estimation Method and Data

The standard approach to investigate both the long-run relationship and short-run dynamics between economic variables is the cointegration analysis and its error correction model (ECM) representation. In this approach, the well known Engle-Granger (1987) and Johansen (1991) procedures require the data series to be integrated of the same order[1]. For variables integrated of different order, an alternative procedure in cointegration analysis is that of autoregressive distributed lag (ARDL) procedure advanced by Pesaran and Shin (1995, 1996). In this procedure, the dependent and the explanatory variables with different degrees of integration can enter the regression with different lags. It involves two stages of estimation. In the first stage, the existence of long-run relation between the variables is investigated by computing the F-statistic for testing the significance of the lagged levels of the variables in the error correction form of the ARDL model. The second step is to estimate the coefficient of long-run relation and the short-run dynamics for drawing inferences. The estimation procedure[2] is given below. For three variables, the error correction version of ARDL model of the following type is considered in the first stage.

$$\Delta Y_t = a_0 + \sum_{i=1}^{p} b_i \Delta Y_{t-i} + \sum_{i=1}^{q} c_i \Delta X_{t-i} + \sum_{i=1}^{r} d_i \Delta Z_{t-i} + \delta_1 Y_{t-1} + \delta_2 X_{t-1} + \delta_3 Z_{t-1} + u_t \quad (1)$$

where X, Y and Z are the three variables, p, q and r are the order of lags for the three variables, respectively and a_0 is the fixed effect[3].

The stability tests or the tests for existence of long-run relationship involve testing the null of non-existence of the long-run relationship, $H_0 : \delta_i = \delta_2 = \delta_3 = 0$ i.e., all the coefficients of lagged levels of the variables in (1) are equal to zero, against $H_1 : \delta_i \neq 0$, $\delta_2 \neq 0$, $\delta_3 \neq 0$. This is done by estimating the F-statistic for joint significance of $\delta_{I,}$ δ_2 and δ_3.

Rejection of the null implies that the coefficient of the lagged levels of the variables are jointly different from zero and there exist long-run relationship between the variables. Since in this case, Y is the explained variable, X and Z are the long-run forcing variables *i.e.,* the change in long-run value of Y would be explained by movements in the values of X and Z, and if there is any long-run causality between Y, X and Z, it would run from X and Z to Y. However, the reverse directions of long-run relationship and causation can also exist. This can be checked by computing the F-statistics following the same procedure for each of the variable as the dependent variable. If the null is rejected only for one particular variable then it is inferred that the long-run relationship between the variables is unidirectional and the causality, if any, would run from the other variables to this dependent variable. Similarly, rejection of the null for two variables and three variables would imply bi-directional and tri-directional long-run relationship between the variables with possible bi-directional and tri-directional long-run causality, respectively[4].

The second stage involves estimating the long-run coefficients by selecting the optimum lag for each of the variable based on various model selection criterions, such as, Akaike Information Criterion (AIC) and Schwarz Bayesian Criterion (SBC), and then estimating the error correction model for the selected lags of the variables. The representative error correction model would be of the following type:

$$\Delta Y_t = \alpha_0 + \sum_{i=1}^{p} b^*_i \Delta Y_{t-i} + \sum_{i=0}^{q} c^*_i \Delta X_{t-i} + \sum_{i=0}^{r} d^*_i \Delta Z_{t-i} + \varphi [Y_t - \phi_1 X_t - \phi_2 Z_t]_{t-1} + u_t \qquad (2)$$

In (2), $[Y_t - \phi_1 X_t - \phi_2 Z_t]_{t-I}$ is the error correction term obtained from the estimated long-run relationship $[Y_t = \phi_1 X_t + \phi_2 Z_t, + \varepsilon_t]$ and ϕ_1 and ϕ_2 are the long-run coefficients of the two explanatory variables. φ is the coefficient of the error correction term which measures the speed of adjustment toward the long-run equilibrium following disturbances, and when statistically significant with right

sign, it shows long-run causality of Y by X and Z. The short-run dynamics are represented by the coefficients of first differences of the variables *viz.,* b^*_i, c^*_i and d^*_i[5].

The time series is the annual data for the period 1960-61 to 1996-97 at 1980-81 prices culled out from the National Accounts Statistics, Central Statistical Organisation[6]. The Government is represented by the entire public sector as defined in the system of national accounts (SNA). Government transfers are excluded from the total expenditures of public sector though researchers debate over the inclusion/exclusion of transfer payments in defining government expenditure[7]. Thus, total expenditure consists of consumption expenditure of government administration and investment of public sector.

All the variables are in real terms and have been converted to logarithm form. The total investment in the economy (LCF) is included as the third variable. The rationale for using investment is that lack of it is often the constraining factor on growth in a developing economy. Secondly, public sector expenditure would interact with the overall investment in the economy as it can either preempt if it is excessive or complement private sector investment[8]. Thus, level of investment in the economy would be an important long-run forcing variable on income growth.

Section III

Empirical Results

To preempt the appropriate choice of technique of cointegration analysis, the variables are first tested for the order of integration. To ensure robustness of the result, the DF, ADF and PP tests were performed, both with and without trend.

It is seen from the results presented in Table1 that, except for LTE, LCF and LTEN, different tests show contradictory results reflecting different degrees of integration. There are also contradictions in the test results obtained with trend and without trend. Thus, no

robust results are obtained on the degree of integration of the data series[9]. Consequently, the ARDL procedure of cointegration analysis as explained above has been adopted.

Table 1: Unit-Root Tests for Selected Variable (1960-61 to 1996-97)

Variable	DF Test		ADF Test		Phillips-Perron Test	
	Levels	First Differences	Levels	First Differences	Levels	First Differences
I. With a constant and no trend						
LTE	-0.44	-6.26*	-0.41	-5.91*	-2.09	-6.30*
LCE	-0.34	-4.19*	-0.40	-4.10*	-1.94	-5.58*
LY	2.02	-8.24*	4.42*	-4.52*	4.46*	-8.3*
LTEY	-2.11	-7.08*	-1.77	-5.63*	-4.24*	-8.52*
LTEN	-0.60	-6.31*	-0.44	-5.94*	-2.37	-6.33*
LYN	1.33	-8.1*	4.09*	-4.38*	3.12*	-8.14*
LCF	0.64	-7.42*	1.35	-4.69*	0.72	-10.83*
II. With a constant and trend						
LTE	-2.77	-6.15*	-2.64	-5.80*	-3.24	-6.67*
LCE	-1.66	-4.12*	-2.33	-4.01*	-3.66*	-6.29*
LY	-1.92	-9.18*	-0.08	-4.97*	-1.52	-10.2*
LTEY	-1.74	-7.12*	-1.02	-5.83*	-1.83	-12.1*
LTEN	-2.94	-6.21*	-2.81	-5.86*	-3.50	-6.66*
LYN	-2.32	-9.20*	-0.04	-4.94*	-1.45	-10.3*
LCF	-2.92	-7.82*	-1.84	-4.80*	-3.41	-11.18*

* Indicates rejection of the null hypothesis of unit root at the 95% confidence level. DF and ADF tests were performed using maximum lag length of 4, and from this maximum, the appropriate lag length for each of the variable was chosen based on SBC.

Bivariate Model

The stability test, or the test for existence of long-run relationship, is conducted for all the six models mentioned in section II. The ARDL of order 4 with an intercept and no trend were estimated for the purpose[10].

Table 2: Test for Long-Run Relationship in Bivariate Models (1960-61 to 1996-97)

	Formulations	F-Statistics	F-Statistics
I.	LTE and LY	LTE on LY = 0.34	LY on LTE = 7.61*
II.	LCE and LY	LCE on LY = 1.16	LY on LCE = 7.84*
III.	LTE and LYN	LTE on LYN = 0.99	LYN on LTE = 8.53*
IV.	LTEY and LYN	LTEY on LYN = 4.33	LYN on LTEY = 8.50*
V.	LTEN and LYN	LTEN on LYN = 0.61	LYN on LTEN = 8.50*
VI.	LTEY and LY	LTEY on LY = 3.76	LY on LTEY = 8.86*

* denotes rejection of null at 99% confidence level based on the critical value bounds computed by Pesaran *et al* (1996).

The results are presented in Table-2. It can be seen that the F-statistics are significant at 99% confidence level when various forms of public sector expenditure form the long-run forcing variables on the national income (column 3). For the reverse long-run relationships (column 2), none of the F-statistics are significant at the 95% confidence level. Thus, it follows that if there exist any stable long-run relationship between public sector expenditure and national income in India, it is the former that has long-run influences on the latter or its per capita, and not the reverse. In other words, there is no evidence for validity of Wagner's law in the Indian context. Rather, the relationship between public sector expenditure and national income in India works in the Keynesian fashion.

The second stage estimate ascertains the exact nature of the long-run influence of public sector expenditure on national income and the associated short-run dynamics in the error correction framework. The long-run coefficients are estimated based on the SBC and AIC model selection criterion[11]. As can be seen from Table 3, SBC despite selecting lower order of ARDL model estimates relatively much lower value of standard errors, and thus the models selected by this criterion were preferred.

Table 3: Estimates of Long-Run Coefficients for Bivariate Models (1960-61 to 1996-97)

	Formulations	Schwarz Bayesian Criterion	Akaike Information Criterion
I.	LY on LTE	ARDL(1,4) LTE = 1.01 (0.232)* C = 2.28 (1.82)	ARDL(1,4) LTE = 1.01 (0.232)* C = 2.28 (1.82)
II.	LY on LCE	ARDL(1,0) LCE = 1.02 (0.39)** C = 2.53 (3.0)	ARDL(3,0) LCE = 1.77 (3.49) C = -2.92 (25.6)
III.	LYN on LTE	ARDL(2,0) LTE = 1.14 (1.73) C = -5.64 (16.1)	ARDL(4,4) LTE = -2.14 (13.2) C = 24.35 (120.5)
IV.	LYN on LTEY	ARDL(1,1) LTEY = -0.52 (.209)** C = 3.91 (0.36)* T = 0.028 (0.0026)*	ARDL (4,3)LTEY = -0.77 (0.42) C = 3.42 (0.78)* T = 0.038 (0.012)**
V.	LYN on LTEN	ARDL(4,4) LTEN = -3.96 (24.3) C = 16.96 (74.25)	ARDL(4,4) LTEN= -3.96 (24.3) C = 16.96 (74.25)
VI.	LY on LTEY	ARDL(1,0) LTEY = -0.65 (0.19)* C = 9.79 (0.32)* T = 0.050 (0.002)*	ARDL(1,0) LTEY = -0.65(0.19)* C = 9.79 (0.32)* T = 0.050 (0.002)*

Figures in the parentheses are the standard errors. * and ** denote significance at 1% and 5%, respectively. 'C' stands for constant term and T stands for trend.

The estimates of the long-run coefficients in the models show that public sector expenditure, either the total (LTE) or only consumption component (LCE) has positive effect on the national income or its per capita (models (I) to (III)). Of these three, the coefficients are significant in models (I) and (II) only, and in both the cases, the values are close to one[12]. On the other hand, when public sector expenditure is in per capita term or scaled by the national income (models (IV) to (VI)), the sign of the coefficients are negative. The negative coefficient, however, is not statistically significant in (V). These negative coefficients in (IV) and (VI), combined with positive coefficients in (I) and (II), would imply that there is a limit to the positive impact of public sector expenditure on national income. In other words, while public sector expenditure *per se* has a positive impact on income growth, excessive growth that leads to rise in its share to national income would have a negative impact on national income.

Table 4: Estimated Error Correction Models for Bivariate Models (1960-61 to 1996-97)

Formulations	Estimated Equations and Diagnostic Tests
I. LY←LTE	$\Delta LY = 0.19 + 0.076\Delta LTE - 0.29\Delta LTE_{(-1)} + 0.09\Delta LTE_{(-2)} - 0.27\Delta LTE_{(-3)} - 0.08E_{(-1)}$ (0.62) (0.84) (-3.2)* (1.1) (-3.3)* (-1.01) R-bar square = 0.35; F (5,27) = 4.65 (0.003) DW = 2.19
II. LY←LCE	$\Delta LY = 0.19 + 0.077\Delta LCE - 0.075E_{(-1)}$ (0.41) (0.99) (-0.74) R-bar square = 0.055; F (2,30) = 1.93 (0.163) DW = 2.35
III. LYN←LTE	$\Delta LYN = -0.26 + 0.053\Delta LTE - 0.463\Delta LYN_{(-1)} - 0.047E_{(-1)}$ (-1.34) (1.22) (-2.71)** (- 0.44) R-bar square = 0.22; F (3,29) = 4.05 (0.016) DW = 2.15
IV. LYN←LTEY	$\Delta LYN = 1.38 + 0.01\ Trend - 0.369\Delta LTEY - 0.354E_{(-1)}$ (2.59)** (2.91)* (-4.42)* (-2.71)** R-bar square = 0.44; F (3,29) = 9.82 (0.00) DW = 2.29
V. LYN←LTEN	$\Delta LYN = -0.33 + 0.11\Delta LTEN - 0.22\Delta LTEN_{(-1)} + 0.24\Delta LTEN_{(-2)} - 0.21\Delta LTEN_{(-3)}$ (-1.0) (1.1) (-1.91)*** (2.55)** (-2.22)** $- 0.55\Delta LYN_{(-1)} - 0.41\Delta LYN_{(-2)} - 0.53\Delta LYN_{(-3)} + 0.02E_{(-1)}$ (-2.72)** (-2.03)*** (-3.03)* (0.19) R-bar square = 0.49; F (8,24) = 4.90 (0.001) DW = 2.26
VI. LY←LTEY	$\Delta LY = 3.44 + 0.018Trend - 0.23\Delta LTEY - 0.35E_{(-1)}$ (3.03)* (3.60)* (-3.57)* (-3.21)* R-bar square = 0.35; F (3,29) = 6.77 (0.001) DW = 1.97

Figures in the parentheses are the t-values. * , ** and *** denote significance at 1%, 5% and 10%, respectively. The terms E in the estimates are the error correction terms.

The error correction models in Table 4, however, show that the coefficients of the error correction term defining the speed of adjustment toward the long-run equilibrium between the variables are significant and are of the right sign in models (IV) and (VI) only. In other words, long-run causality in the bivariate models are discerned only when total public sector expenditure is scaled to national income, and the nature of the causality is such that rise in the share of public sector expenditure in national income leads to decline in the growth of national income and its per capita income. However, there are short-run interactions among the variables in almost all the models.

The results in Table 3 and Table 4 may be summarised as follows: Growth of public sector expenditure, either the total or the consumption component, is indicated to have a positive long-run relationship with national income. However, the estimated

relationships are not in equilibrium and do not show any long-run causality *i.e.*, there is lack of adjustment and the long-run relationship cannot persist. In contrast, rise in the share of total public sector expenditure in national income causes decline in both the national income and its per capita, and are indicated to be stable relationships with any deviations from these equilibriums following shocks being corrected by about 35.0 percent within a year.

In the short-run, there are strong indications that public expenditure, whether absolute or scaled to national income or in per capita, has a negative impact on national income. When there are scarcities of investment fund in the economy at the margin, increase in public sector expenditure would crowd out private investment and adversely impact income growth. Wherever relevant, the lag effects of per capita income is negative, indicating inherent built-in stability in the growth of per capita income *i.e.*, decline in the post-boom and *vice versa.*

The lack of long-run causality in most of the bivariate models above may follow due to omission of relevant variable. Further, introducing such variable may alter the results and the inferences drawn.

Trivariate Case

The corresponding trivariate models are estimated by including total investment as the third variable. The tests for long-run relationship between the three variables are presented in Table 5. The F-statistics are statistically significant, either at the 99% or at the 95% confidence level, only for national income or its per capita as the dependent variable and public sector expenditure (either absolute or relative) and investment as the long-run forcing variables (column 4). Reverse relationships (in column 2 and 3) are not statistically significant for any of the models.

Table 5: Test for Long-Run Relationship in Trivariate Models (1960-61 to 1996-97)

Formulations	F-Statistics	F-Statistics	F-Statistics
I. LTE , LY & LCF	LTE on LY, LCF = 0.2	LCF on LY, LTE = 2.94	LY on LTE, LCF = 6.52*
II. LCE , LY & LCF	LCE on LY, LCF = 1.17	LCF on LY, LCE = 2.05	LY on LCE, LCF = 4.72**
III. LTE , LYN & LCF	LTE on LYN, LCF = 06	LCF on LYN, LTE = 1.51	LYN on LTE,LCF = 5.77**
IV. LTEY, LYN & LCF	LTEY on LYN, LCF = 3.9	LCF on LYN, LTEY = 1.25	LYN on LTEY,LCF= 5.60**
V. LTEN, LYN & LCF	LTEN on LYN, LCF =0.86	LCF on LYN, LTEN = 1.25	LYN on LTEN,LCF= 5.60**
VI. LTEY, LY & LCF	LTEY on LY, LCF = 2.75	LCF on LY, LTEY = 2.9	LY on LTEY,LCF = 8.61*

*denotes rejection of null at 99% confidence level and ** at 95% confidence level based on the critical value bounds computed by Pesaran *et al* (1996).

The long-run coefficients, therefore, need to be estimated only for income as the dependent variable[13]. The results presented in Table 6 show that, whether by SBC or AIC criterion, the coefficients of investment (LCF) are significant at 1% significance level, and are also positive in all the models. As in the bivariate models, the coefficients of public sector expenditure are not significant in (III) and (V), and in the rest, they are significant and are also of the same sign as in bivariate case. However, the absolute values of the coefficients are much lower than those estimated under bivariate models, particularly (I) and (II). The models selected by SBC, except in (II), have been selected for the error correction models, as the standard error for similar or larger coefficients are lower.

Table 6: Estimates of Long-Run Coefficients for Trivariate Models (1960-61 to 1996-97)

Formulations	Schwarz Bayesian Criterion	Akaike Information Criterion
I. LY on LTE, LCF	ARDL(1,4,0) LTE = 0.29 (0.14)** LCF = 0.60 (0.15)*, C=2.8(.38)*	ARDL(1,4,0) LTE = 0.29 (0.14)**, LCF = 0.60 (0.15)* , C=2.8(.38)*
II. LY on LCE, LCF	ARDL(1,0,0) LCE = 0.28 (0.15)** LCF = 0.60 (0.17)*, C=2.97(.50)*	ARDL(1,4,0) LCE = 0.31 (0.12)* LCF = 0.54 (0.14)*, C= 3.32(0.4)*
III. LYN on LTE, LCF	ARDL(1,0,0) LTE = -0.12 (0.12) LCF = 0.59 (0.13)*, C=0.37(0.32)	ARDL(4,4,0) LTE = -0.06 (0.27) LCF = 0.75 (0.43)*, C=-1.6(2.6)
IV. LYN on LTEY, LCF	ARDL(1,1,0) LTEY = -0.22 (0.12)** LCF = 0.49 (0.03)*, C=-0.13(0.44)	ARDL(4,4,0) LTEY = -0.13(0.22) LCF = 0.56 (0.1)*, C=0.65(1.1)
V. LYN on LTEN, LCF	ARDL(1,1,0) LTEN = -0.16 (0.17) LCF = 0.57 (0.11)*, C=0.02(0.5)	ARDL(4,4,0) LTEN= 0.02 (0.42) LCF = 0.68 (0.37)*, C=-1.6(2.9)
VI. LY on LTEY, LCF	ARDL(1,0,0) LTEY = -0.41 (0.13)* LCF = 0.30 (0.12)*, C=7.4(1.0)* T = 0.033 (0.006)*	ARDL(1,0,1)LTEY = -0.53 (0.2)* LCF = 0.13 (0.21)*, C=8.8(1.7)* T = 0.042 (0.012)*

Figures in the parentheses are the standard errors. * and ** denote significance at 1% and 10%, respectively. 'C' stands for constant term and T stands for trend.

The findings on long-run coefficients may be summarised as follows: Public sector expenditure, total (LTE) or the consumption component (LCE), have long-run positive impact on national income as in the bivariate models. The magnitude of the positive impact (about 0.29), however, is much lower than indicated in the bivariate case (about 1.0) due to total investment in the economy explaining more for economic growth than public sector expenditure[14]. As in bivariate models, rise in the share of public sector expenditure in national income (LTEY) leads to decline in both the national income (LY) and its per capita (LYN). Irrespective of the specification, investment in the long-run positively impact income growth. Thus, the inclusion of investment as the third variable neither changes the directions of causation nor seriously alters the significance level of the explanatory variables as obtained in bivariate models, *albeit* the absolute value of the coefficients of public sector expenditure are dampened markedly.

Table 7: Estimated Error Correction Models for Trivariate Models (1960-61 to 1996-97)

Formulations	Estimated Equations and Diagnostic Tests
I. LY←LTE, LCF	$\Delta LY = 0.84 + 0.044\Delta LTE - 0.28\Delta LTE_{(-1)} + 0.042\Delta LTE_{(-2)} - 0.27\Delta LTE_{(-3)} + 0.18\Delta LCF - 0.3\ E_{(-1)}$ (2.27)* (0.54) (-3.5)* (0.54) (-3.7)* (2.61)* (-2.75)* R-bar square = 0.47; F (6,26) = 5.88 (0.001) DW = 2.23
II. LY←LCE, LCF	$\Delta LY = 1.35 + 0.022\Delta LCE - 0.041\Delta LTCE_{(-1)} + 0.053\Delta LCE_{(-2)} - 0.32\Delta LCE_{(-3)} + 0.22\Delta LCF - 0.3\ E_{(-)}$ (2.48)* (0.16) (-0.34) (0.47) (-3.0)* (2.94)* (-2.95)* R-bar square = 0.33; F (6,26) = 3.78 (0.001) DW = 2.01
III. LYN←LTE, LCF	$\Delta LYN = 0.18 - 0.055\Delta LTE + 0.28\ \Delta LCF - 0.474E_{(-1)}$ (0.94) (-0.99) (3.40)* (-3.39)* R-bar square = 0.30; F (3,29) = 5.63 (0.004) DW = 2.37
IV. LYN←LTEY, LCF	$\Delta LYN = -0.064 - 0.32\Delta LTEY + 0.239\ \Delta LCF - 0.487E_{(-1)}$ (-0.30) (-4.33)* (4.23)* (-3.99)* R-bar square = 0.56; F (3,29) = 14.75 (0.00) DW = 2.18
V. LYN←LTEN, LCF	$\Delta LYN = 0.007 - 0.08\Delta LTEN + 0.27\Delta LCF - 0.48E_{(-1)}$ (0.03) (-1.0) (3.58)* (-3.39)* R-bar square = 0.30; F (3,29) = 5.64 (0.004) DW = 2.33
VI. LY←LTEY, LCF	$\Delta LY = 3.65 + 0.016Trend - 0.204\Delta LTEY + 0.148\ \Delta LCF - 0.49E_{(-1)}$ (3.39)* (3.45)* (-3.36)* (2.12)* (-4.0)* R-bar square = 0.42; F (4,28) = 6.82 (0.001) DW = 1.80

Figures in the parentheses are the t-values. * denotes significance at 5%. The terms E in the estimates are the error correction terms.

The estimated error correction models, however, differ significantly from that of the corresponding bivariate models. Table 7 shows that all the ECM equations without exception now pass the diagnostic tests and the equations are also much more precisely estimated than the corresponding bivariate models. The coefficients of the ECM terms are also significant at least at the 5% significance level in all the equations. The signs are also correct implying that the long-run causalities flow from public sector expenditure to national income, either positively or negatively, depending upon the degree of its growth. Interestingly, the speed of adjustment towards equilibrium defined by the coefficients of the ECM terms are also of equivalent magnitudes for similar specification of public expenditure. Thus, for public sector expenditure when not scaled (LTE and LCE), the speed of adjustment is about 30.0 percent within a year (models (I) and (II)). When scaled by population or national income (models (III) to (VI)), the speed of adjustment is uniformly about 48 to 49 percent within a year. Where the bivariate models show unstable equilibrium, the corresponding trivariate models now show a stable long-run equilibrium. For models (IV) and (VI) whose bivariate models also show stable equilibrium, the speeds of adjustment are higher in the trivariate models.

With regard to short-run dynamics, irrespective of the model formulation, growth in investment leads to rise in national income and its per capita. On the other hand, increase in public sector expenditure, irrespective of its specification, has net negative impact on income growth, as the coefficients which are statistically significant have negative signs on balance. Interestingly, the magnitudes of the impact are similar between comparable bivariate and trivariate models ((I), (IV) and (VI)).

Section IV

Concluding Remarks

The paper attempts to analyse the dynamic interaction between the public sector expenditure and national income in India during the period 1960-61 to 1996-97 for both bivariate models and trivariate models, with total investment included as the third variable

in the latter. It finds the existence of a stable long-run relationship between public sector expenditure and national income in India and the causality strictly running from the former to the latter. This is in contrast to Jha and Seth (1995) who found the causality in the reverse direction[15]. Public sector expenditure has a long-run positive impact on national income, but the same increase in public sector expenditure does not lead to increase in per capita income. This again is in contrast to the positive effect found in Jha and Seth (1995). On the other hand, if public sector expenditure growth is more than national income growth, that is, the share of public sector expenditure in national income rises, then it reduces the growth in both the national income and also its per capita. This indicates that excessive growth of public sector expenditure has a long-run detrimental effect on growth, which would follow as a result of higher public sector expenditure leading to excessive draft on private sector savings and investment.

In the short-run, the impact of growth in public sector expenditure on income growth is unambiguously negative. In a resource scarce economy, when there are competitions for funds at the margin, rise in public sector expenditure may preempt fund for the private sector such that overall investment and growth in the economy is dampened in the short-run irrespective of whether there is crowding in or crowding out effect in the long-run. For investment, whether it is the long or the short-run, its increase leads to growth in income.

National income growth in India, thus, seems to be investment or demand led. Though public sector expenditure has a positive impact on national income, it is detrimental to income growth when excessive, as private sector investment would be crowded out. Thus, there is the need for maintaining a proper balance between public sector expenditure and investment for economic growth in India.

Notes :

[1] There are at least three methods *viz.*, Dicky Fuller (DF), Augmented Dickey Fuller (ADF) and Phillips-Perron (PP) tests for testing the order of integration of the data series.

[2] For detailed derivation of the testing and estimation procedure, refer to Pesaran and Shin (1995, 1996). The following is based on Pesaran and Pesaran (1997).

[3] In this error correction version employed for the first stage, the current values of the explanatory variables ΔX and ΔZ are not considered as it is not known a priori whether X and Z are the long-run forcing variables for the explained variable Y. Once the existence of the long-run relationship is established by the stability tests, they are included in the second stage estimating the long-run coefficients and the error correction model (Pesaran and Pesaran, (1997)).

[4] Unlike the Engle-Granger and Johansen procedure which estimates error correction models for each of the variables involved in the cointegration analysis, in this procedure, the number of error correction models required to be estimated depends upon the number of long-run relationships determined by the stability tests.

[5] It may be noted that the lag lengths p, q and r in (1) and (2) are not the same. They have been retained only for notational convenience. In (1) they are the maximum order of lag length assigned to the variables for conducting the stability tests. In (2) the lag orders are the appropriate lags selected for each of the variables from the maximum lags based on the selection criterion adopted for the estimation of long-run coefficients. It may also be noted that, as explained in footnote (4), the instantaneous values of the explanatory variables are included in this error correction framework.

[6] This is the old national income series, but has been preferred as the new series covering the period up to 2000-01 reflects some inconsistency among various tables. Information on public sector investment at constant prices for the period prior to 1960-61 is not available.

[7] Ram (1986, 1987) argues that transfer payments should be excluded to make total government spending definition truly compatible with Wagner's ideas. On the other hand, Bird (1970), Musgrave and Musgrave (1988) favour its inclusion in government spending.

[8] Objection may be raised that public sector investment is a part of both total investment and total public sector expenditure, which are two separate variables in the models. However, it is true that national income also includes part of public sector expenditure, which is public sector investment, though they are the two variables tested for relationship in the literature.

[9] For the ratio variables LTEY, LTEN and LYN, it is indicated that the correct model specification for unit root tests should be without including a time trend while for variables which are not ratios i.e., LTE, LCE and LY, the tests should be with the inclusion of a trend. Even then the alternative tests contradict each other for some of the variables. For examples, LCE is non-stationary by Phillips-Perron test with trend while LYN and LTEY are non-stationary by the same test without trend. Thus, at least one of the variable appears to be non-stationary in each of the six models.

[10] There is no set criterion for selecting ARDL of order 4, which is the maximum order of lags, in the stability tests. This order was chosen as it gave the best F-statistics on the stability test and the coefficients for higher lags were found to be statistically insignificant. The number of data points was also kept in view while selecting the order.

[11] The F-statistics obtained from variable deletion tests suggest inclusion of a trend component for models (IV) and (VI), while in the rest, inclusion of trend are rejected. Therefore, the long-run coefficients for models (IV) and (VI) were estimated with a deterministic trend.

[12] That the impact of public consumption expenditure and total public expenditure has the similar impact on national income may indicate the unimportance of distinction in public sector

expenditure and/or the problem of biased estimate due to omission of variables determining national income.

[13] F-tests indicate that a trend should be included in the case of model (VI).

[14] The impacts of total expenditure and consumption components of expenditure on national income are similar as in the bivariate models. The crowding in/out effect of public investment on private investment, and therefore, on national income depends upon the sector in which public investments are made. Public consumption expenditure also has a positive impact on private consumption expenditure (see for example, Report on Currency and Finance, 2000-01, RBI). Interestingly, in the estimation of national income in India, hike in wages and salaries of public sector employees, which is part of public sector current expenditure, is reflected in the growth of national income as public sector's contribution to national income is calculated on the cost of public services provided.

[15] The definition and the source of information on real public sector expenditure and also the time period in this referred study differ from the present study. It may be noted that National Accounts Statistics by Central Statistical Organisation (CSO) in India, the present source of information, has not published data on real public sector investment for the period prior to 1960-61, though the referred study covers the period 1950-51 to 1960-61.

References:

Abizadeh, S., and J. Gray, (1985), "Wagner's Law: A Pooled Time-Series, Cross-Section Comparison", *National Tax Journal*, Vol.38, No.2, pp. 209-18.

Courakis, A.S., F. Moura-Roque and G. Tridimas (1993), "Public Expenditure Growth in Greece and Portugal: Wagner's Law and Beyond", *Applied Economics*, Vol.25, No.1, pp. 125-34.

Ganti, S., and B.R. Kolluri, (1979), "Wagner's Law of Public Expenditures: Some Efficient Results for the United States", *Public Finance/Finances Publiques*, Vol.34, No. 2, pp. 225-33.

Goffman, I.J., (1968), "On the Empirical Testing of Wagner's Law: A Technical Note", *Public Finance/Finances Publiques*, Vol.23, No. 3, pp. 359-64.

Government of India, National Accounts Statistics, Central Statistical Organization, Various Issues.

Gupta, S.P., (1967), "Public Expenditure and Economic Growth: A Time-Series Analysis", *Public Finance/Finances Publiques*, Vol. 22, No.4, pp. 423-61.

Gyles, A.F., (1991), "A Time-Domain Transfer Function Model of Wagner's Law: The Case of the United Kingdom Economy", *Applied Economics*, Vol. 23, No. 2, pp. 327-30.

Henrekson, M., (1993), "Wagner's Law-A Spurious Relationship?", *Public Finance/ Finances Publiques*, Vol. 48, No.2, pp. 406-15.

Hondroyiannis, G., and Papapetrou, E., (1995), "An Examination of Wagner's Law for Greece: A Cointegration Analysis", *Public Finance/Finances Publiques*, Vol. 50 (1), pp. 67-79.

Jha, R. and Seth, S., (1995), "Causal Relation Between Public Expenditure and National Income Growth in India", *Indian Journal of Applied Economics*, Vol. 4, pp. 11-25.

Kyzyzaniak, M., (1974), "The Case of Turkey: Government Expenditures, the Revenue Constraint and Wagner's Law, *Growth and Change*, Vol.5, No.2, pp. 13-19.

Mann, A.J., (1980), "Wagner's Law: An Econometric Test for Mexico, 1925-1976", *National Tax Journal*, Vol.33, No.2, pp. 189-201.

Michas, N.A., (1975), "Wagner's Law of Public Expenditures: What is the Appropriate Measurement for a Valid Test", *Public Finance/Finances Publiques*, Vol. 30, No. 1, pp. 77-84.

Murthy, V.N.R., (1993), "Further Evidence of Wagner's Law for Mexico: An Application of Cointegration Analysis", *Public Finance/Finances Publiques*, Vol. 48, No.1, pp. 92-96.

Musgrave, R.A., (1969), *Fiscal Systems* (New Haven London: Yale University Press).

Musgrave, R.A., and B. Musgrave (1988), *Public Finance in Theory and Practice*, 5th ed. (New York:McGrow-Hill Book Company).

Peacock, A. and A. Scott, (2000), "The Curious Attraction of Wagner's Law", *Public Choice*, Vol. 102, Nos. 1-2, pp. 1-17.

Peacock, A.T., and J. Wiseman, (1961), *The Growth of Public Expenditure in the United Kingdom* (Princeton: Princeton University Press).

Pesaran, M.H. and Pesaran, B., (1997), "*Working Microfit 4.0*", Oxford University Press.

Pesaran, M.H. and Shin, Y., (1995), " An Autoregressive Distributed Lag Modelling Approach to Cointegration Analysis", *DAE Working Paper No. 9514*, Department of Applied Economics, University of Cambridge.

Pesaran, M.H. and Shin, Y., (1996), " Cointegration and Speed of Convergence to Equilibrium", *Journal of Econometrics*, Vol. 71, pp. 117-43.

Pluta, J.E., (1979), "Wagner's Law, Public Sector Patterns, and Growth of Public Enterprises in Taiwan", *Public Finance/Finances Publiques*, Vol.7, No.1, pp. 25-46.

Pryor, F.L., (1968), *Public Expenditures in Communist and Capitalist Nations* (London: George Allen and Unwin).

Ram, R., (1986), "Causality Between Income and Government Expenditure: A Broad International Perspective", *Public Finance/Finances Publiques*, Vol. 31, No.3, pp. 393-413.

Ram, R., (1987), "Wagner's Hypothesis in Time Series and Cross Section Perspectives: Evidence From Real Data for 115 Countries", *Review of Economics Statistics*, Vol. 69, No. 2, pp. 359-93.

Reserve Bank of India, (2002), Report on Currency and Finance, 2000-01.

Singh, B. and Sahni, B.S., (1984), "Causality Between Public Expenditures and National Income", *Review of Economic and Statistics*, Vol. 66, No.4, pp. 630-44.

Upender, M., (1995), "The Income Elasticity of Public Expenditure in India: An Empirical Investigation", *Prajnan*, Vol. XXIV, No. 2., pp. 111-123.

Vatter, H.G., and J.F. Walker, (1986), "Real Public Sector Employment Growth, Wagner's Law, and Economic Growth in the United States", *Public Finance/ Finances Publiques*, Vol. 41, No. 1, pp. 116-36.

Wagner, R.E., and W.E. Weber, (1977), "Wagner's Law, Fiscal Institutions, and the Growth of Government", *National Tax Journal*, Vol. 30, No. 1, pp. 59-68.

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Exchange Rate Dynamics: An Indian Perspective

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Based on monthly data from January 1996 to March 2002 on exchange rate, net purchase by the Reserve Bank of India, data on open market operations in the debt market and Nominal Effective Exchange Rate (NEER), the paper develops a Generalised Autoregressive Conditional Heteroskedastic (GARCH) model for USD/INR exchange rate. Major conclusions of the paper are the following: (i) central bank intervention reduces volatility in the market; (ii) open market operations in the debt market in the case of sterilised intervention reduces volatility in exchange rate and (iii) NEER plays a dominant role on return and volatility. Besides, results indicate that USD/INR exchange rate and NEER are cointegrated.

JEL classification: E58; F31

Key words: Central Bank Intervention; Cointegration; GARCH; Nominal Effective Exchange Rate; Open Market Operations.

Introduction

Wide ranging literature is available on the effectiveness of central bank intervention in the foreign exchange market. Most of the central banks use sterilised intervention as part of their foreign exchange market operations. The dispute on the effectiveness of sterilised interventions is unresolved ever since the so-called Jurgensen report (Jurgensen, 1983). Even though empirical literature finds weak evidence in this regard, central banks continue to use this instrument as a major policy tool.

Another related issue on which there is no clear cut solution is the effect of intervention on volatility in foreign exchange market. Fatum and Hutchison (1999), Doroodian and Caporale (2001), among others, used GARCH framework to analyse the problem and found that interventions enhanced volatility in some of the markets. However, using an event study methodology commonly used in finance, Fatum

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(1999) concluded that sterilised intervention is indeed effective. Humpage (1996) studied DEM/USD rates using binary choice models on daily data and found that intervention is systematically associated with exchange rate movements. In a series of papers, Dominguez and Frankel emphasised the signaling effect of intervention that would work on expectation of institutional investors. Ito (2002) studied the effectiveness of central bank operations in the USD/ JPY market; he made interesting observation to the effect that intervention strategy adopted by Dr.Sakakibara, when he was Director General of International Finance Bureau, Bank of Japan, was distinctively different and highly successful.

In a related study, Bofinger and Wollmershaeuser (2001) found that many countries classified by International Monetary Fund (IMF) as "independent float" are actually "managed float"; the major difference between independent and managed float is the active intervention by the central bank. In other words, pure float or independent float remains a theoretical proposition with active intervention being done by central banks without such intervention being in the public domain.

As Bofinger and Wollmershaeuser (2001) pointed out, literature on intervention is mainly on a few developed countries and thus it would be difficult to generalise these results to developing countries such as India. One of the major difficulties in studying the problem for other countries is lack of data on central bank intervention operations. Bhattacharya and Weller (1997) developed a theoretical model to study behavioural pattern of central banks and found supporting evidence in 'hiding one's hand' while concluding that secrecy about the scale of an intervention operation is always desirable. However, this hampers progress in further research in the field as the data requirements can be satisfied only in the case of some of the developed countries.

Against the above background, based on monthly data from January 1996 to March 2002 on exchange rate of the Indian rupee (INR), net purchase by the Reserve Bank of India, data on open market operations in the debt market and Nominal Effective Exchange Rate (NEER), this paper develops a Generalised Autoregressive

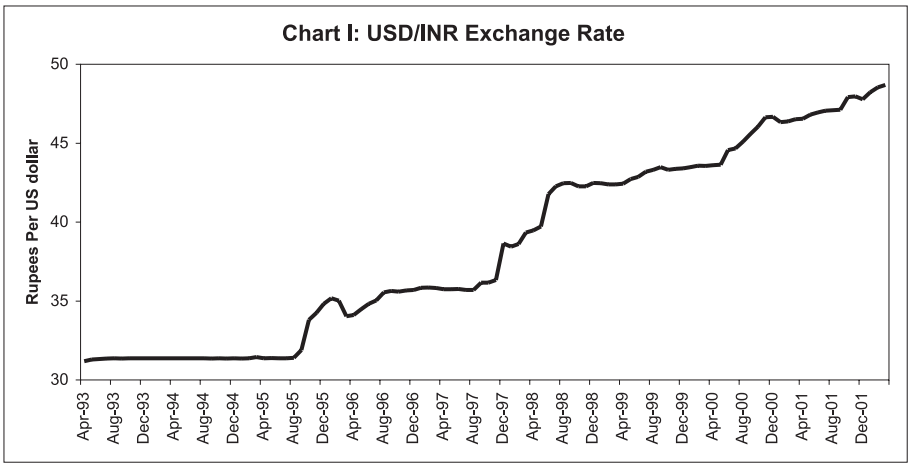
Conditional Heteroskedastic (GARCH) model for USD/INR exchange rate. Analysis of data is undertaken in Section I, followed by the model results in Section II. The paper concludes with major observations.

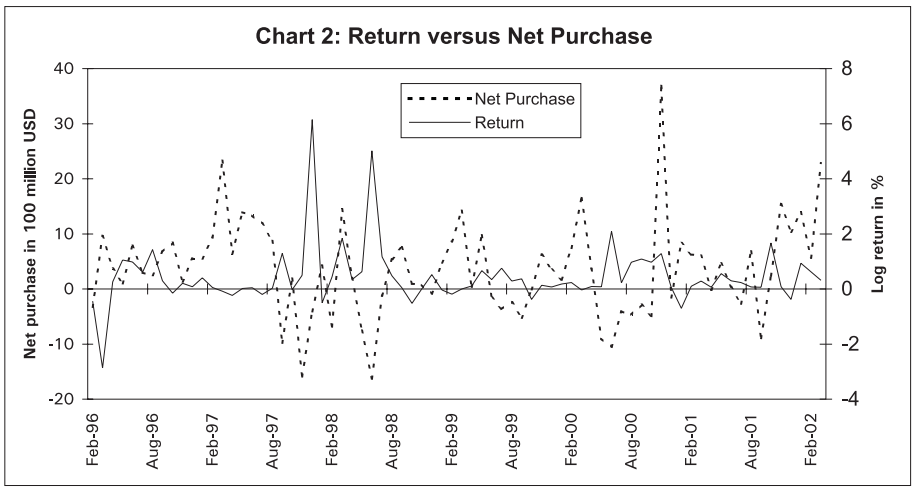
Section I

Analysing the Data

In India, the Reserve Bank of India (RBI) has been regularly publishing its total market purchase and sale on a monthly basis; this is inclusive of forward and swap market operations on value date basis. The paper first reviews the monthly published data from January 1996 to March 2002 and then develops a GARCH model for log return on USD/INR rate. This of course is not enough to study the impact of RBI interventions in the market and the short-term effect essentially gets smoothed out while using the aggregate monthly data. Nevertheless, it enables us to give a panoramic view of its policies adopted in the USD/INR market at the macro level. In addition to intervention data, we also use Nominal Effective Exchange Rate (NEER) as independent variable in the model; details are given in Section II.

Plotting the movement of USD/INR exchange rate from April 1993 to March 2002, it is clear that ever since the Indian rupee became 'fully float', there were longer stable periods as coupled with occasional periods for greater exchange rate volatility (Chart 1). Being a developing market, the Reserve Bank of India necessarily has to intervene in the market to relieve the pressure either from excessive appreciation or from volatile depreciation of its currency. The major objectives of exchange rate management by the Reserve Bank of India inter alia include containing undue volatility in the foreign exchange markets and meeting temporary demand-supply mismatches due to lump sum demand or lag effect.





In order to study whether RBI adopts a 'leaning-against-the-wind' policy at least at the macro level or not, we plot log return in percentage (*i.e.*, $\Delta \ln(\text{INR}(t))*100$, where INR(t) is the price of one USD in Indian Rupee and Δ is the difference operator) and the Reserve Bank of India intervention in USD million in Chart 2. This plot indicates an interesting pattern: most of the time, whenever return moves downward, net purchase moves upwards and vice versa and the correlation between the two is -0.28, which is statistically significant. This justifies the common perception that, at least at the macro policy making level, the central bank adopts a 'leaning-

against-the-wind' policy. This can be explained further: whenever INR is depreciating the Reserve Bank of India provides USD to the market and whenever INR is appreciating the Reserve Bank of India absorbs USD from the market, resulting in negative relationship between the two variables. We may explain this negative relationship further from the stated policy objective of the Reserve Bank of India: "... the prime objective of the Reserve Bank is to manage volatility with no fixed target for the exchange rate which is determined by market forces" (RBI Annual Report, 2001-02, page 10). From the stated objective, we may infer that the Reserve Bank of India stand is against volatility and not necessarily against any particular trend in the market. This means that when INR is depreciating against USD, it will continue to depreciate but the objective is only to temper the rate at which it is depreciating. Similarly, when INR is appreciating the Reserve Bank of India may try to temper the speed of appreciation. In both the cases, the relationship between the two variables is negative. One hypothetical example in an INR appreciating scenario may help in understanding this better. Suppose that the rate opens at Rs.48.57 against USD and assume that it is the closing rate of the previous day also. The rate moves to Rs.48.50 per USD at some occasion during the day and at this time point the Reserve Bank of India purchases USD from the market and the rate moves to Rs.48.53 per USD, due to reduced supply of the US dollar in the market. Thus, if the time of intervention is known, the relationship between net purchase and return before and after intervention will be positive. However, suppose that the rate closes at Rs.48.53 per USD so that compared to the previous day close, return is negative and still net purchase is positive, yielding a negative relationship. In such a scenario, the Reserve Bank of India is not against a particular trend in the market but only against volatility and negative relationship is natural. A similar argument may be given in a depreciating scenario too. Thus, we may reach the following conclusions, depending on data availability:

i) If the time of intervention is known, the Central Bank intervention may be termed successful if the relationship between the return before intervention and after intervention and net purchase during the intervention period is positive. Based on this, Almekinders and Eijffinger (1994) have argued that within a

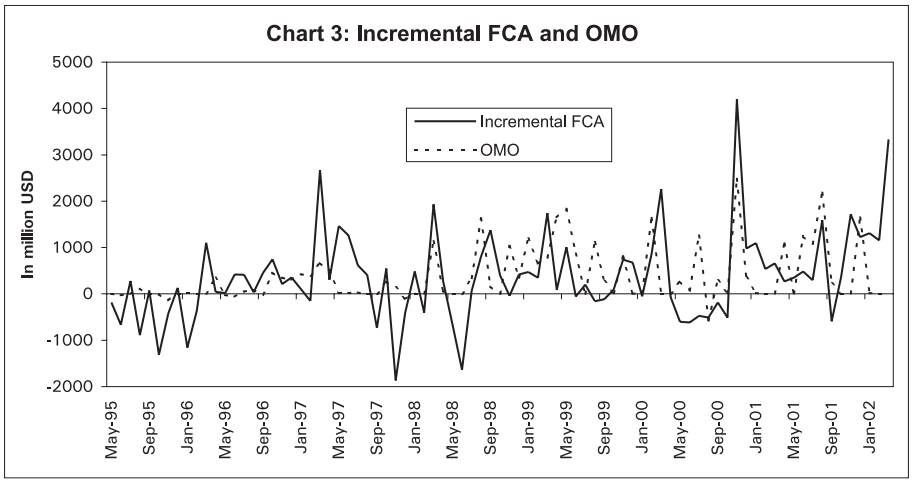
GARCH model setup, coefficient of the intervention variable should be positive in the mean equation and negative in the variance equation.

ii) However, when the time of intervention is largely unknown, but total intervention amount is known, then the relationship between the two is likely to be negative. This is especially true for currencies with uni-directional movements like INR and also when data are available only on monthly basis.

These issues are further explored in Section II.

Based on the curve for net purchase of USD from Chart 2, a few more observations on the nature of interventions could be made. During January 1996 – March 2002, maximum monthly net purchase occurred in November 2000 at USD 3.69 billion while the minimum net purchase occurred in June 1998 amounting to USD -1.63 billion. Average monthly net purchase during the period was USD 0.35 billion with a standard deviation of 0.87. While net monthly purchase of more than USD 0.9 billion occurred 20 per cent of the times during the period, that below USD -0.9 billion occurred only during 5.33 per cent.

Another important aspect of the Reserve Bank's market operation is with regard to the sterilisation operation and its effect on exchange rate. The Reserve Bank has been publishing data on open market operations (OMOs) in the money market on a monthly basis. In order to control impact of foreign exchange interventions on money markets, it may be possible that the liquidity added or depleted is absorbed back or pumped into the market by the Reserve Bank. One way of getting a picture on the combined operation is to look at incremental Foreign Currency Assets (FCA) during a month and the corresponding OMO figures. Chart 3 plots these two variables. It is interesting to note the co-movements of these variables. During the whole period, the correlation between them is 0.37 and, during January 1998 to May 2001, the correlation is 0.46, indicating that during the periods of high increase in FCA, OMO was also high. Even though it is not possible to separate out the effects of OMO due to 'liquidity operations' and 'sterilisation operations', there seems to be an overall relationship between the increase in FCA and the OMO.



The monthly data published by the Reserve Bank on its foreign exchange market interventions have some limitations. The published data are purchase, sale during the month and outstanding net forward sales and purchases at the end of the month. The purchase and sale are inclusive of swaps and forwards, which do not influence the spot market directly but influence it through expectations. Strictly speaking, only spot, forward and swap interventions with cash flows within the month are to be considered for the analysis. However, given the published data, it is neither possible to obtain spot intervention data nor possible to make crude adjustments. For instance, forwards maturing in a specific month may be high but the overall net position may be much lower. Thus, analysis given here is subject to these limitations.

Section II

Model Specifications and Results

The objective of the present section is to explore the relationship among major variables in the context of exchange rate management using a GARCH model, especially with respect to the effectiveness of intervention activities of central banks. GARCH models have been used in such situations by Almekinders and Eijffinger (1994), Fatum and Hutchison (1999), Doroodian and Caporale (2001), Ito

(2002), among others. Independent variables considered here are Nominal Effective Exchange Rate (NEER), Real Effective Exchange Rate (REER), Net Purchases (NetP) and Open Market Operations (OMOs) by the central bank. Dependent variable in the GARCH set up is log return on exchange rate of Indian Rupee (INR); to be precise, let INR(t) denote price of one US Dollar in INR, then log return is defined as $\Delta\ln(INR(t))$. Both ln(INR) and ln(NEER) have unit roots, as reported in Table 1 below based on weighted symmetric (WS) and Dicky-Fuller (DF) unit root tests. Thus modeling based on differenced log series for these two variables are justified.

Table 1: Unit root tests for NEER and USD/INR exchange rate

Test	ln(NEER)		ln(USD)	
	Test Statistic	**P-Value**	**Test Statistic**	**P-Value**
WS Test	-1.8194	0.7599	-1.8432	0.7467
DF Test	-1.5821	0.7994	-2.6338	0.2646

Relationship among the variables can be broadly specified in the following regression model:

$$\Delta\ln(INR(t))=f(\Delta\ln(NEER(t),\ln(REER(t)),OMO(t),h(t))+\varepsilon(t)$$

where $\varepsilon(t)$ is distributed as Normal(0, h(t)) and h(t) is the volatility parameter; h(t) is modeled in a GARCH framework as

$$h(t)=g(\text{lags of } \varepsilon(t)^2, \Delta\ln(NEER(t)), \ln(REER(t)),OMO(t)).$$

Preliminary model with all variables included both in mean and in variance equations is given by

$$\ln(INR(t)) = \underset{(-1.68)}{-0.35} + \underset{(1.38)}{0.01}\, NetP(t) - \underset{(-0.27)}{0.00}\, OMO(t) - \underset{(-2.27)}{0.50}\, \Delta\ln(NEER(t))$$

$$+\underset{(1.12)}{0.23}\, \ln(REER(t)) + \underset{(-2.22)}{0.80}\, h(t)^{0.5} + \varepsilon(t)$$

$$h(t) = 0.25 + 0.99\ \varepsilon(t-1)^2 - 0.02\ NetP(t) - 0.03\ OMO(t) - 0.24\ \Delta\ln(NEER(t)) - 0.23\ \ln(REER(t))$$
(3.08) (17.26) (-2.32) (-3.04) (1.69) (-1.85)

R^2=0.39; D.W. =2.14.

Clearly, the model requires modification by dropping insignificant variables from both the equations. After deleting least significant variable one at a time, we arrived at the following model:

$$\ln(INR(t)) = -0.29 + 0.01\ NetP(t) - 0.27\ \Delta\ln(NEER(t)) + 0.79\ h(t)^{0.5} + \varepsilon(t)$$
(-1.39) (1.19) (-7.42) (2.16)

$$h(t) = 0.24 + 1.00\ \varepsilon(t-1)^2 - 0.02\ NetP(t) - 0.03\ OMO(t) - 0.24\ \Delta\ln(NEER(t)) - 0.24\ \ln(REER(t))$$
(3.20) (26.36) (-2.25) (-3.67) (1.79) (-2.04)

R^2=0.38; D.W. =2.01.

Major observations from this equation are the following:

1. NetP is not significant in the mean equation, even though it has correct sign in the sense of Almekinders and Eijffinger (1994).
2. NEER has significant impact on the mean equation.
3. All major variables that we are considering have significant impact on the volatility of returns. Particularly, NetP, REER and OMOs have significant impact on volatility equation.

If we drop the insignificant NetP from the mean equation, even REER in the volatility equation becomes insignificant and the modified model is as follows:

$$\ln(INR(t)) = -0.07 - 0.24\ \Delta\ln(NEER(t)) + 0.56\ h(t)^{0.5} + \varepsilon(t)$$
(-3.07) (-3.50) (2.67)

$$h(t) = 0.27 + 0.74\ \varepsilon(t-1)^2 - 0.02\ NetP(t) - 0.01\ OMO(t)$$
(7.09) (16.58) (-6.76) (-1.79)

R^2=0.36; D.W. =2.02.

Based on this final model, we may observe the following:

1. REER does not appear at all.
2. Both NetP and OMOs have significant influence on the behaviour of volatility in the market.
3. Also NEER plays a significant role in mean equation, indicating its influence on expectations.

The negative coefficients of NetP and OMO have important policy implications. The pronounced policy of the central bank in exchange rate management is that its main objective is volatility containment and orderly market conditions. The final equation captures this effectively: Net purchases by the central bank reduce volatility in the market, which is in alignment with the pronounced policy. Besides, even the sterilisation operations assist in containment of volatility. Thus it may be said that the central bank is successful in its policy objective.

Since the final model indicates that NEER and not REER plays major role in exchange rate dynamics of Indian Rupee, it is desirable to see whether the relationship between NEER and exchange rate is true in long term perspective too. In order to study long term relationship between exchange rate and NEER we tested for cointegration of these variables after log transformation. Engle-Granger cointegration test statistic value was -3.41 with P-value 0.12, indicating that these two variables are cointegrated. Thus, these variables move in tandem in the long run, which further reinforces the general perception on the role of NEER in the exchange rate.

Section III

Concluding Remarks

The paper explores effectiveness of the central bank intervention on USD/INR exchange rate. It was found that the central bank adopts a policy of 'leaning-against-the-wind' at macro level, as reflected in negative correlation between exchange rate return and net dollar purchases by the central bank; it is further reinforced through the GARCH models. However, it cannot be interpreted as a policy against appreciation or

depreciation of the domestic currency; instead, it reflects a stand against volatility in the market. In fact, the GARCH model effectively captures the central bank policy of volatility containment, indicating that RBI is successful in achieving the objectives of intervention policies. It was also found that log-differenced NEER has significant effect on return; besides, movement of NEER is indicative of the direction of USD/INR exchange rate in the sense of long term relationship captured through cointegration.

References

Almekinders, G.J. and Eijffinger, C.W.S. (1994), The Ineffectiveness Of Central Bank Intervention. *Center for Economic Research,* No.94101.

Bhattacharya, U. and Weller, P. (1997), The Advantage to Hiding One's Hand: Speculation and Central Bank Intervention in the Foreign Exchange Market, *Journal of Monetary Economics*, Vol. 39, 251-277.

Bofinger, Peter and Wollmersshaeuer, Timo (2000), Managed Floating: Understanding the New International Monetary Order, Working Paper No. 3064, *Center for Economic Policy Research.*

Doroodian, K. and Caporale, T. (2001), Central Bank Intervention and Foreign Exchange Volatility, *International Advances in Economic Research,* Vol. 7, No. 4, pp. 385-392, November 2001.

Fatum, R. (1999), On the Effectiveness Of Sterilised Foreign Exchange Intervention, *SCCIE Working Paper* No.99-2.

Fatum, R. and Hutchison, M.M. (1999), Is Intervention a Signal Of Future Monetary Policy? Evidence from the Federal Funds Futures Market, *Journal of Money, Credit and Banking,* 31:1.

Humage, O.F. (1996), U.S. Intervention: Assessing the Probability Of Success, Federal *Reserve Bank of Cleveland Working Paper* No. 9608.

Ito, Takatoshi (2002), Is Foreign Exchange Intervention Effective? The Japanese Experience in the 1990s, *NBER working paper* 8914.

Jurgensen, P. (1983), *Report of the Working Group on Exchange Market Intervention*, Washington, Treasury Department.

Reserve Bank of India, Annual Report, 2001-02.

Reserve Bank of India Bulletin, Various issues.

Reserve Bank of India Occasional Papers
Vol.22, Nos.1, 2 and 3, Summer, Monsoon and Winter, 2001

Special Notes

Who Needs the IMF as an International Lender of Last Resort?

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In the context of the growing international perception that the International Monetary Fund (IMF) cannot and should not function as an International Lender of Last Resort (ILOLR), this note presents a perspective on why the emerging market economies need the IMF as an ILOLR. It argues that the risk of financial instability and associated loss of output and employment is a more serious concern than the risk of moral hazard, and that an effective and credible ILOLR can make the current process of globalisation less painful and disorderly. It highlights that a transparent and financially empowered IMF can enhance the effectiveness of national Lender of Last Resort (LOLRs) in dealing with twin crises. It also emphasises the point that international initiatives on crisis prevention/resolution undertaken as part of the work programme on new international financial architecture should not be viewed as a substitute for ILOLR. The ILOLR would continue to be relevant, irrespective of the degree of progress that can be achieved on these initiatives.

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Introduction

The conclusion of the Twelfth General Review of Quotas in January 2003 with a decision against any increase in the general resources of the IMF clearly weakened the capacity of the IMF to function as an International Lender of Last Resort (ILOLR). The decision, however, helped in formally validating the argument that has been gaining ground since the Mexican crisis of December 1994 that the IMF cannot and should not function as an ILOLR. According to this view, the Bagehot (1873) principle would require that like a domestic LOLR, the ILOLR should be in a position to *lend freely, at a penal rate, and on good collaterals*. Other than possibly using a penal rate on its lending, IMF cannot meet the other requirements. Hence, IMF cannot be an ILOLR (Schwartz, 1999). Also, the IMF should not perform the role of an ILOLR

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because that would accentuate the moral hazard problem and thereby encourage more imprudent lending and borrowing and ultimately give rise to financial crises (Calomiris, 1998). Some even argue that any increase in the general resources of the Fund may be made, if necessary, only after the present work on constructive Private Sector Involvement (PSI)/Sovereign Debt Restructuring Mechanism (SDRM) achieves the envisioned objective, since an early increase in general resources could in fact raise the moral-hazard problem and weaken the response of both creditors and debtors to such initiatives.

The argument that the IMF cannot and should not be the ILOLR essentially reflects the position of advanced countries who in fact do not require an ILOLR, because their domestic LOLRs can fill the vacuum due to their ability to create international liquidity. Central Banks of emerging market economies, however, cannot create international liquidity and they generally find it the most difficult to arrange international liquidity from any source amidst a crisis. In the absence of a credible ILOLR, they often try to strengthen the capacity of their domestic LOLRs by pursuing a policy of maintaining high foreign exchange reserves. Such a self-insurance centric domestic financial architecture not only comes at the expense of less flexible exchange rates, but also entails several other costs which could have been avoided to some extent with an ILOLR. The moral hazard argument has been conveniently used to stall appropriate financial empowerment of the IMF, despite the fact that IMF liabilities have rarely been defaulted by emerging markets and that countries actually approach the IMF only as a last – not first – resort due to the fear of intrusive conditionality package that accompanies Fund assistance. The growing impact of contagion on the prospects of emerging markets and the general unpredictability of the timing and intensity of any crisis suggest that liquidity needs of a country at times could change dramatically, and could be large as well. In this context, a role for an ILOLR is justified on the ground that it may be more appropriate to support the country where crisis strikes first with quick provision of adequate international liquidity, instead of allowing the contagion to show its full strength and then assist a number of countries with larger liquidity.

The objective of this paper is to present an emerging market perspective on the need for an ILOLR. For developing the rationale behind an ILOLR, one needs to examine first the relevance of all the arguments that support the view that the IMF cannot and should not take up the role of an ILOLR. Accordingly, Section I sets out the basic functions of any domestic LOLR and evaluates the extent to which IMF can perform those functions at the international level. Section II encapsulates all the arguments on moral hazard and presents a comparative assessment of the costs, with or without ILOLR. Section III presents the arguments as to how the IMF can, and why it should function as the ILOLR. Section IV offers a few concluding observations.

Section I

The Difference Between LOLR and ILOLR

Since the origination of the idea in the 19th Century by Thornton (1802) and Bagehot (1873), the architecture of an ideal LOLR has been extensively debated, even though the essential elements of any LOLR continue to be more or less the same even today. According to Saxton (1999):

(i) The LOLR has a macroeconomic rather than microeconomic responsibility. Only when the failure of an insolvent individual institution threatens the stability of both the financial system and the value of money that the LOLR should make available adequate liquidity. Unsound institutions should be allowed to fail, unless they have important spillover effects.

(ii) The fractional reserve system of banking and the government monopoly over issuance of legal tender suggest that while the former creates a need for LOLR the latter provides the means for satisfying the need.

(iii) The LOLR function, which is a short-run stabilisation role, should not conflict with the medium- to long-term goal of a Central Bank, particularly price stability.

(iv) An important function of any LOLR being to avert panic, it should be transparent. To minimise the moral hazard problem, however, it must make the point loud and clear that liquidity will not be provided to insolvent banks directly, but only to the market or at best to the solvent and sound banks directly who can offer appropriate collateral while receiving the liquidity support at a penal rate. Transparent assurance to "lend freely to the market at a penal rate on good collateral" ensures that lending remains short-term and that borrowers exhaust all other private sources of fund and approach the LOLR genuinely as a last resort.

In practice, most of the above essential elements are difficult to realise. The most important challenge that any LOLR encounters is to distinguish between solvent and insolvent banks. As underscored by Freixas *et al* (1999), "a central bank may not always be able to make this distinction, particularly in the short time-scale in which a lending decision may have to be made". The argument that the LOLR should lend only to the market through open market operations also presumes that the markets must be efficient, so that all solvent banks can get enough liquidity from the inter-bank market. Insolvent banks, in turn, would automatically be eliminated from the system. In reality, the inter-bank market suffers from information problem and it cannot differentiate the banks on the basis of their solvency in any way better than a national regulator/ supervisor, even when information disclosure and transparency norms are in place. Coordination problem could also prevent access to liquidity for some solvent banks amidst a run on the bank. In view of the moral hazard problem associated with a policy of transparency, LOLRs often maintain "constructive ambiguity" under which the liquidity support is determined on an *ad-hoc* and *ex-post* basis. As emphasised by Niskanen (2002), "central banks are, in the final analysis, faced with a time inconsistency problem. Even if an LOLR facility were beneficial *ex-post*, *i.e.* after a liquidity shortage has occurred, expectations of support from such a facility may weaken the bank's incentives *ex-ante* in a way that makes the occurrence of a liquidity shock even more probable". This justifies a policy of constructive ambiguity. Rochet and Vives (2002), however, suggest that transparency can be better than constructive ambiguity, provided

the LOLR policies could be based on the principles that guide the "private lines of credit" of commercial banks. In such a case, LOLR would assume a contractual character which need no longer provide liquidity support "free of charge, without limits, and at the complete discretion of the central bank". The LOLR function then should be guided by: (i) payment of commitment fees *ex ante* by the banks, (ii) explicit limits on the access to liquidity support, and (iii) compliance with preconditions (say, proper risk management and prudential regulation). In this context, it is interesting to note the findings of a study by Herrala (2001) which compares the social desirability of three alternative governance structures of LOLR: a public lender of last resort, a mutual clearing house that formulates policy by voting, and a profit maximising private LOLR scheme. Voluntary/private schemes succeed as long as all recipients of liquidity repay loans with interest, so that the LOLR does not suffer losses. When the LOLR suffers losses, good quality banks would tend to stay away and only weaker banks would join the scheme. Hence, LOLR in the public sector may remain as the only viable option.

In the context of the debate on transparency *versus* constructive ambiguity, Guttentag and Herring (1983) differentiate between three different forms of commitment that the LOLR can do in advance: (i) it explicitly states what it is able and prepared to do and what it is not prepared to do, (ii) it promises less than what it is able and prepared to do, and (iii) it promises more than what it is able and prepared to do. The last one is a clear prescription for disaster, and should always be avoided. Between the first two, even though the Bagehot prescription would favour the first option, the more appropriate policy of any LOLR could be based on the second option. Constructive ambiguity that represents the second option, however, could provide some unavoidable advantage to large banks who may be too big to fail.

Irrespective of these above operational challenges, every national economy operates with a LOLR, and as highlighted by Guttentag and Herring (1983), real life experience suggests that " central to the LOLR function is a willingness to accept a risk unacceptable to other lenders…Because of capital market imperfections, the LOLR

function requires direct credit extensions to individual banks. …The social costs associated with bank failures during a financial crisis are larger than private costs." To avoid the social costs, a LOLR could willingly assume risks that the private market would refuse to bear. Hence, "banking crises are preventable by an LOLR at relatively small social cost". Economic historians, such as Kindleberger (1989) and Bordo (1990) also found that the development of LOLR has helped in reducing the frequency and severity of national banking crises.

Unlike any national LOLR, the IMF cannot lend freely, constrained by the lack of ability to issue international liquidity. Decisions like the one taken under the Twelfth General Review of Quotas can further constrain its capacity to lend freely. It also cannot lend quickly, due to the requirement of Board approval and acceptance of conditionality by the national authorities. It is more difficult for the Fund than any national LOLR to differentiate solvency crisis from liquidity crisis. Most importantly, it can at best lend against conditionality, but not against good collaterals, since a country in the midst of a crisis may not possess internationally acceptable collaterals at its disposal. It can lend at penal rates, as it has done against purchases under the Supplemental Reserve Facility (SRF), but SRF is neither backed by any additional Fund resources (hence it competes with conventional Fund facilities for limited resources at the disposal of the Fund) nor is it subject to the usual access limits (enlarging thereby the scope for discretion, which could potentially be used to favour a few preferred Fund members). The lack of any progress on the Contingent Credit Lines (CCL) also clearly shows that penal rates and intrusive pre-qualifying norms may not be acceptable to a vast majority of Fund members, even when CCL could have the typical features of an ILOLR. All these elements which constrain the IMF's ability to function as an ILOLR are examined in greater detail in Section III in the context of the analysis justifying an ILOLR role for the IMF.

Section II

Greater Evil - Moral Hazard or Global Financial Instability?

Balancing the moral hazard risk against the meltdown risk is the key challenge for an ILOLR. The international perception, which is essentially a pro-market view advanced and propagated by the first world, seems to have overemphasised the risk of moral hazard. Litschig (2001) went to the extent of arguing that moral hazard was the key determinant of financial crises in emerging markets in the 1990s. Expectation of an official bailout induced overtly risky behaviour by creditors. Since the Mexican bailout "creditors have learned that there is an implicit IMF guarantee on capital flows to large emerging markets and that a risk premium can be collected without incurring the risk". As a result of the Mexican bailout, international investors could collect a risk premium of about 6 per cent without assuming any risk, because the bailout essentially equated the 12 per cent Mexican sovereign debt with the 6 per cent US Treasury securities. According to Calomiris (1998), an ardent supporter of the moral hazard argument, "if the risk taking bankers know that future gains from taking on risk will be private, but losses will be borne by taxpayers, that amounts to a government subsidy for risk, which thereby encourages excessive risk taking (the so called moral hazard problem)". Based on these arguments, IMF bailouts, as the experience of Mexico and Indonesia would suggest, lead to emergence of the wealthy and the politically influential risk-takers as winners and the taxpayers as biggest losers. Furthermore, recent IMF bailouts, instead of preventing panic, actually facilitated transfer of wealth from taxpayers to insolvent financial institutions and international creditors. He recommends, therefore, that policy makers should realise how counterproductive IMF bailouts could be and why IMF's resources should not be expanded for financing bailouts.

More than an ILOLR, therefore, what the global financial architecture requires is stronger and more effective crisis prevention measures. As stressed by Kaufman (1999), "the need is not for a lender of last resort, the need is for improved supervision and regulation over the major risk-takers and the major markets….no

matter what happens in the emerging countries, the result will never be a systemic risk (to the global system)". Tietmeyer (1999) also echoed a similar perception by viewing that neither every financial crisis can have systemic implications nor is systemic risk a given quantity. Rather it is an endogenous variable, which is influenced by the structure of financial markets, supervisory framework at the national and international levels, and the decisions of the national political and monetary authorities. The emphasis, therefore, should be on avoidance of systemic risk rather than an ILOLR.

Calomiris (1998), like Kaufman (1999) also viewed that "irrational financial contagion" is not the real concern because history and theory of banking panics suggest that panics have always been rational phenomena. "Thus, concerns of irrational contagion spreading from one country to another without any fundamental explanatory link connecting the countries are unwarranted. Such concerns should not be used to justify financial bailouts." Contagion, however, has been a major source of financial crises in countries having sound fundamentals in the past decade. As underscored by Mishkin (2000), " a successful speculative attack on one emerging market country does lead to speculative attacks on other emerging market countries, which can lead to collapses of additional currencies….An ILOLR has the ability to stop contagion by providing international reserves to emerging market countries threatened by speculative attacks so that they can keep their currencies from plummeting." The formation of the G-20 after the Asian crises is a clear demonstration of the international recognition of the importance of contagion, particularly if it originates in one of the systemically important countries. Besides the concern of contagion and the large output and employment costs associated with banking and currency crises that justify the need for an ILOLR, the following arguments also provide considerable support to the relevance of an ILOLR for the emerging market economies.

i) Sovereign Debt Restructuring Mechanism (SDRM) and constructive Private Sector Involvement (PSI) can prevent unsustainable sovereign debt induced crises; but crises arising from over-lending and over-investment can not be prevented by such initiatives.

ii) Those who target IMF bailouts as the source of moral hazard generally assume that all instances of past IMF financial packages were dealing with sovereign insolvency, rather than illiquidity.

iii) IMF always gets back the crisis time finance it provides to its members. Outstanding arrears at any point of time have been negligible, and with a view to safeguard Fund resources, even the impact of such arrears is completely offset by the burden sharing arrangement that shifts the burden to the Fund members.

iv) As rightly emphasised by Litschig (2001), "the governments of Mexico, Thailand, Korea, Indonesia or Brazil were merely illiquid, rather than insolvent, as witnessed by their success in avoiding default on private claims and their early repayment of the IMF financing that was made available".

v) Most importantly, the ILOLR has to lend to sovereign governments, not to the banks/private creditors directly. Unlike the creditor moral hazard, there is hardly any sovereign moral hazard (unless it is made out to be so through biased arguments). Moreover, to determine as to whether a sovereign is insolvent or merely illiquid is an art rather than a science. Hence, in the absence of sovereign moral hazard, the ILOLR should provide international liquidity without being motivated by the concern of creditor moral hazard. Absence of ILOLR would not necessarily make domestic LOLRs to stop doing what they have been doing.

vi) International initiatives on crisis prevention are no substitute for an ILOLR. Progress on PSI/SDRM, effective Fund surveillance, promotion of transparency and compliance with international standards and codes, *etc.* could reduce the need for an elaborate ILOLR, but cannot deliver what an ILOLR can. No emerging market needs an ILOLR as a substitute for reform. They, however, feel that despite pursuing sound macroeconomic policies and having strong financial systems, they can still encounter situations of liquidity crises.

vii) Ramifications of a default on Fund liability are too costly; that itself is the best collateral against which the Fund should lend freely.

viii) To sustain and deepen the process of globalisation (which almost all the supporters of the moral hazard argument want), national financial and corporate entities have to necessarily increase their exposures to different international currencies. In the international context, national financial institutions have to not only ensure appropriate maturity transformation but also prudent transformation of currency exposures. Liquidity problem arising from asset-liability mismatch in terms of both maturity and currency exposure can be addressed only to a limited degree by national central banks, depending on the exchange rate regime and the size of the foreign exchange reserves in relation to the aggregate exposure. An ILOLR, thus, is a global safety-net that is essential to deal with the challenges of growing globalisation.

The above assessment clearly suggests that the need for avoiding global financial crises is a much more serious concern than the risk of moral hazard. The objective of the debate on the new global financial architecture, therefore, should be to strengthen the crisis prevention framework and to undertake measures that could contain the scope for moral hazard. Such initiatives, however, should not undermine the importance of an ILOLR. As noted by Frankel (1999), "moral hazard is not to refrain from ameliorating the effects of a given crash …moral hazard cannot be the fundamental (source of) market failure". Little and Olivei (1999) echoed a similar concern that "the absence of a reliable ILOLR may have increased the volatility of investor sentiment, aggravating herd behaviour". A well functioning international capital market cannot do the job of an ILOLR. As the pattern of private capital flows to emerging markets in the last decade reveals, there has been high degree of concentration of such flows in few emerging markets and when any of these countries needs such capital the most it may actually experience a rush for exit by the private creditors. A large number of countries do not get adequate foreign private capital when they need, but face the pangs of contagion once it starts. As noted by Goodhart and Huang (2000), "when there is an international inter-bank market, the total amount of necessary liquidity to meet pure liquidity shocks to be provided by an ILOLR is smaller than that when there is no international inter-bank market". The risk of

contagion, however, increases when the international inter-bank market exists and grows in importance over time. An ILOLR, therefore, is required to deal with the uncertainty arising from the failure of international inter-bank market.

Section III

Empowering the IMF as an ILOLR.

Lack of adequate resources has been a major factor that severely constrains the IMF to assume the role of an ILOLR. Further financial empowerment of the Fund, however, was deliberately stalled in the Twelfth General Review of Quotas. Sufficient financial empowerment of the Fund is crucial for enhancing its capacity to undertake credible crisis prevention and resolution measures. It needs to be noted that crises in the capital account have completely changed the dynamics of demand for Fund resources. A small number of large arrangements can take the Fund to exhaustion limit. Past recent arrangements in Mexico, Thailand, Korea, Russia, Brazil, Argentina and Turkey suggest that individual arrangements were much in excess of what any quota linked financing would have warranted. For Korea and Turkey the arrangements were 1939 per cent and 1560 per cent of their respective quotas. Further, more than 70 per cent of the agreed resources under these high access arrangements were made available within one year. As several countries like Mexico, Brazil, Korea and Russia effected repurchases ahead of schedule, that relieved the pressure on Fund's resource position to a great extent. But there are cases like Argentina that requested for an extension of repurchase and Turkey that financed its SRF obligations by using stand-by resources. It may be noted that if the above seven countries alone (with an aggregated actual quota of about 17.4 billion SDRs) get into a crisis simultaneously and require ten times their respective quotas under the high access arrangements, the Fund would not be able to meet the demand, even after tapping the entire amount available under General Agreement to Borrow and New Arrangement to Borrow (GAB and NAB). If these countries together request for extension of repurchase, the Fund's revolving financing mechanism itself may completely

breakdown. There is a high degree of discretion and flexibility in dealing with arrangements under exceptional access facilities like the SRF and there has been evidence of high degree of credit concentration in few countries in the 1990s, which may also threaten the financial position of the Fund given the mandated need to safeguard its resources. It was just a coincidence that 88 per cent of the arrangements entered into after 1995 were within the normal access limits of stand-by and EFF. If the number of exceptional arrangements increases in future and if the CCL is also activated after suitably streamlining the scheme, Fund's present level of resources may appear grossly inadequate.

The costs associated with any shortfall in Fund resources to deal with future crises are also asymmetric as far as the creditors and debtors are concerned. The creditors, who may like to delay any early augmentation in Fund resources, have little to loose even when they agree to an augmentation because they earn a remuneration at market related rate and make available their resources only when needed by the Fund, depending on the Financial Transaction Plan (FTP) for any quarter. The potential costs for the debtors stemming from inadequate Fund resources, however, could be substantial, particularly in a globalised system where channels of contagion are stronger and more disruptive.

The argument that an early augmentation of fund resources may raise the moral hazard problem and disrupt the ongoing work on PSI/SDRM is not entirely correct. Only a financially stronger and more credible IMF can broker deals between debtors and private creditors; the incentive to enter into any IMF brokered deal will be higher for both private creditors and debtors when the size of Fund financing under an arrangement would be expected to be higher. The debtors can be better disciplined and the private sector can be more effectively bailed-in to share the burden of adjustment during the stabilisation programmes only when the Fund will have the resources and the willingness to extend financial assistance to countries depending on their need during a crisis. Again, on the ground of containing moral hazard, stiffer conditionality should not be attached to higher access facilities like the SRF. Rather the catalytic role of the Fund be strengthened so that Fund's resources

can be better safeguarded by creating the fear among the debtors that unless the repurchase schedules of the IMF are met, the access to private capital could be significantly constrained. PSI and SDRM can help in strengthening the international architecture for crisis prevention and resolution. But they cannot be viewed as substitutes of what an ILOLR is expected to do.

It may be correct that Fund's resources proved sufficient to deal with the series of emerging market crises in the 1990s. But in the absence of the 45 per cent augmentation through the Eleventh Review, one is not sure whether the condition would have been the same. Fund resources aim at dealing with uncertainty and a key fundamental fact of the globalisation process in the recent years has been greater uncertainty.

Other than the argument based on possible disruption of the SDRM/PSI initiative, several other arguments have also been offered to stall any augmentation of the Fund's quota-based general resources. One view would suggest that the future demand for Fund resources is difficult to quantify in view of the uneven behaviour of the key determinants of the quotas (*i.e.* the variables used in alternative quota formulas) in the recent period, as also the heightened uncertainty about the timing and the nature of future crises. Another view may emphasise that financial globalisation has led to increasing reliance on private capital. Hence, mechanisms that could ensure greater participation of the private creditors in crisis prevention/resolution may be more credible and effective than a mere augmentation of Fund resources. The Fund could contribute to strengthen the effectiveness of such mechanisms by adapting its surveillance policies more appropriately, ensuring improved vulnerability assessment, greater transparency, compliance with international standards and codes, and rigorous external assessment of the strength and resilience of national financial systems. It may be correct that the Fund's current liquidity position has generally been viewed as adequate by historical standards. But, as noted by Fisher (1999), " if the IMF were today the same size relative to the output of its member States as it was in 1945, it would be more than three times larger …If the quota formula applied in 1945 were used to calculate actual quota today, the Fund would be five times its size; and if

the size of the Fund had been maintained relative to the volume of world trade, it would be more than nine times larger – that is, the size of the Fund would be over 2.5 trillion dollars (as against current total quota size of SDR 212.7 billion, or about US $ 290 billion)." The Fund size may have to be even larger if one takes into consideration the demand for Fund resources arising from capital account crises, since private capital flows were not that very important in 1945 as they are today. One also has to keep in perspective that even though newer facilities like SRF and CCL have been introduced/contemplated, they compete with the conventional facilities (like stand-by and EFF) for the general resources of the Fund. Any new facility, however, must be additionally funded – whether through augmentation of the general resources, or through creation of separate Funds as has been done in the case of Poverty Reduction and Growth Facility (PRGF).

If the IMF has to function as an ILOLR, the polar alternatives would indicate that it should be in a position to either "issue an indefinite amount of its own currency that could be widely acceptable at the global level" or "it must have a pool of reserve currencies which is large enough to deal with international liquidity crises". In case of the latter, the key issue is how large should be the pool and what factors should decide the size of the pool. An important consideration in this respect is the distinction that is often made between "lending in last resort as an input to monetary policy" and "lending in last resort as an input to banking policy" (Jeanne and Wyplosz, 2001). In case of the former, monetary and financial stability of the system becomes the overriding objective. Hence, ensuring availability of liquidity to the system as a whole, not just to any specific institution, is what a national LOLR intends to achieve. Through open market operations, liquidity is injected to the system. Institutions that are solvent, get liquidity from the market and not from the LOLR. Insolvent institutions, however, are allowed to perish. This helps in addressing the moral hazard problem (*i.e.* the problem of insolvency being wrongly interpreted as illiquidity by the LOLR). In the global context, for an ILOLR to inject liquidity into financial systems of the affected countries, whether directly or through national central banks who would be conducting the Open Market Operations (OMOs), it must be in a

position to issue its own liquidity. This suggests that only the Federal Reserve (Fed) in the USA can operate as the ILOLR.

This option would not meet the requirements of all emerging markets for a number of reasons. If the Fed injects enough liquidity through the global financial market, many countries may not get the desired amount of international liquidity due to the reasons stated earlier, particularly the observed lopsided pattern of capital flows and the manner in which the inter-bank market for global liquidity functions. Most importantly, if the Fed functions as the ILOLR, it is discriminatory treatment that will become the rule. Unlike Mexico, not many countries could get US $ 12 billion from the Exchange Stabilisation Fund. Nor can they hope to get the type of support that was extended to Korea - an OECD country (Korea received a total package of US $ 57 billion – of which US $ 21 billion that came from the IMF represented 1939 per cent of Korea's quota, another US $ 14 billion was provided by the World Bank and the ADB, and the G-7 agreed to arrange a second line of defence of about US $ 22 billion). Thus, it is the bilateral relationship with the US rather than the genuine liquidity needs of solvent countries that would guide the functioning of the Fed-run ILOLR.

Due to the inability of the inter-bank market to discriminate solvent from the insolvent, the Fed has to operate through the national central banks, who in turn would inject the dollars made available by the Fed into the system (not to specific institutions) against high quality collaterals (like domestic currency denominated bonds and securities). As the objective would be to deal with a liquidity crisis, over time, the swap could be reversed (*i.e.* bonds and securities could be sold and dollars acquired when normalcy restores in the system) and the ILOLR be paid back. Under this arrangement, effectively the ability of a central bank to operate as a LOLR would be enhanced through liquidity support from another central bank, most importantly in foreign exchange. The key dilemma as per this variant of ILOLR is that why should the Fed take up this responsibility: (i) unless its own economic linkages with a country are strong enough to cause systemic concerns for its own financial system, and (ii) when IMF arrangements in any

case bailout the creditors from developed countries at the expense of tax payers of the countries who use conditional Fund resources. The official position of the US has been that as against its 17.7 per cent share in IMF quota, its share in the usable resources of the Fund is as high as 26 per cent, and its share in GAB credit line is also about 25 per cent. The US has also made available these resources to the Fund at more favourable rates than the cost of money to the Government (*i.e.* US Treasury rates), involving a subsidy of hundreds of millions of US dollar per year. IMF remunerations also do not adequately reflect the increased riskiness of IMF lending (Frenze and Keleher, 1999). The essence of this official position is that the US already contributes substantially to the IMF. It would assume additional responsibility, it appears, only if that can help in serving its national interest. There are ample evidences of that as well. When Mexico was extended US $ 12 billion from the Exchange Stabilisation Fund at a penal rate, the Treasury got back the entire amount over a short time span fetching an interest income of about US $ 500 million. When the IMF bails out a country in crisis, it is the private creditors of advanced countries whose imprudent lending behaviour is rewarded and their profit prospects are protected. Crisis also opens up the window to acquire banks and corporates of the crisis affected countries at depressed prices. An ILOLR role for the IMF has been discarded by the advanced countries on the ground that the ILOLR, with capacity to create international liquidity, can give rise to a situation of excess liquidity. It has been a fact, however, that the reserve currency countries often pursue easy monetary policy stance keeping in view the national growth concerns; but such easy national policies have also given rise to excess international liquidity. The Asian crisis was a manifestation of such excess liquidity created by the advanced countries, which were redirected by private creditors to the East Asian countries in search of higher return. Excess liquidity argument has, thus, been conveniently used to stall an ILOLR role for the IMF, though the global financial system has already experienced situations of excess liquidity even without an ILOLR.

In case of lending in last resort as an input to banking policy, on the other hand, failing banks/institutions are extended liquidity support directly. Every country maintains some variant of domestic

banking safety nets and an ILOLR has to only supplement the national efforts. Hence, the resource requirement of the ILOLR need not be large, possibly should be just sufficient to meet the liquidity gaps in the domestic banking sector (liquidity gap defined as the difference between the banking sector's short-term foreign exchange liabilities and their liquid foreign exchange assets). Under this arrangement, the ILOLR could finance the discount window of the domestic central bank or directly offer limited guarantees on foreign exchange liabilities of domestic banks. Solvent banks could get dollars from the central bank under the discount window against good collaterals. To enhance the effectiveness of this arrangement one has to address the agency cost problem (given that the domestic LOLR has to operate as an agent on behalf of the ILOLR -the principal- under this arrangement). As per the fear of agency problem, national LOLRs can bail-out insolvent domestic banks when the ILOLR finances the operation. Over a period of time, the ILOLR has to be paid back by the domestic LOLR. But to safeguard the interest of few insolvent domestic bankers who otherwise should have been allowed to perish, the authorities may transfer the burden to domestic taxpayers while repaying to the ILOLR. To deal with such possible imprudent behaviour of national authorities, the ILOLR may have to possess the maximum possible information about each and every bank/financial institution (implying associated intrusion into regulatory and supervisory frameworks of national governments).

One needs to recognise in this regard the fact that the ILOLR has to necessarily deal with the sovereign government, and the IMF has already strengthened its tools of surveillance to identify the country specific vulnerabilities. Along with regular Article-IV bilateral surveillance, Financial Sector Assessment Programmes (FSAPs) and preparation of Reports on Observance of Standards and Codes (ROSCs) should provide enough information about the member countries, and it should not aim at obtaining information on each bank/financial institution while providing liquidity support. Macro level information should be sufficient for the ILOLR to lend to the domestic LOLR, who in turn could monitor individual banks and decide whether to bailout the solvent/insolvent banks. Decision to bailout an insolvent bank at the expense of tax payers

is a decision that is internal to every national economy, and even in the absence of an ILOLR, such decisions would continue to be taken, though ideally should be avoided. While functioning as an ILOLR, thus, only the relationship between the ILOLR and the LOLR should be important and as long as a country maintains clean track record of honouring all Fund obligations on time, the ILOLR should not be guided by the consideration agency problem.

In practice, the world has seen ILOLR interventions of both variants in the past. In the aftermath of the December 1994 Mexican crisis, US $ 12 billion was made available in January 1995 to Mexico by the US from its Exchange Stabilisation Fund (which was initially created with the objective of stabilising the external value of the US dollar, not Mexican peso). Effectively, the Fed assumed the role of an ILOLR. In other cases, IMF has provided conditional resources to national authorities to deal with twin crises. When its resources proved insufficient, additional resources were mobilised under the General Agreement to Borrow (GAB) and the New Arrangement to Borrow (NAB). Under the GAB, IMF arranged SDR 6.3 billion for Russia in July 1998 and again in December 1998 it arranged SDR 9.1 billion under the NAB for Brazil.

For the IMF to take over the second variant of ILOLR function, sufficient augmentation of its general resources appear critical. Even though the aggregate quota of all members amount to about SDR 212 billion, usable resources at the disposal of the Fund at any point of time are about 30 to 40 per cent less since a large part of the quota based resources are not usable. NAB and GAB can supplement the Fund resources to a maximum of SDR 34 billion. The IMF has the option of assuming the ILOLR function of the first variant also, as under Article XVIII it can allocate SDRs "to meet the long-term global need, as and when it arises, to supplement existing reserve assets". India has also raised this issue on several occasions that IMF could issue SDRs to itself to augment its resources at the time of need and relinquish the additional liquidity so created as and when the member countries effect the repurchases (Jalan, 1999). The complex issues involved in implementing this suggestion are: (i) 85 per cent majority support, (ii) de-linking allocation of SDRs from quotas and linking the disbursement to a country's

liquidity needs, and (iii) the overall international acceptability of SDR when larger volumes of SDRs are created (so far the cumulative allocation amounts to only SDR 21.4 billion, even though the initial objective was to enhance the role of SDR as the principal reserve currency). If this arrangement can be implemented, IMF can effectively create unlimited liquidity and support the national initiatives in bridging any liquidity shortfall.

There is also a perception that lending by the IMF against good collateral may not be feasible (excluding exceptional cases, like the option to use future oil revenue of oil exporting countries as good collateral). IMF has to, therefore, lend against policy, implying thereby the fact that an ILOLR can only function effectively if greater policy intrusion becomes acceptable to the members. As mentioned earlier, IMF has already expanded the scope and coverage of its regular surveillance of members and the spectre of conditionality already haunts the members which have accepted IMF programmes in the last decade or so (Pattanaik and Misra, 2002). ILOLR lending against policy, therefore, is already in vogue. As mentioned earlier, the ILOLR need not seek institution/bank-wise information to ensure that only solvent institutions get the liquidity support from the ILOLR, since that will be the role and purview of national LOLRs.

Section IV

Concluding Observations

The role played by the IMF in dealing with the series of emerging market crises in the last decade has led to a near polarisation of international perceptions on the need for an ILOLR. While the advanced countries feel that the IMF is too generous and that it creates moral hazard through its generous lending which is detrimental to the smooth functioning of the international financial markets, the emerging market economies generally feel that the IMF provides too little too late, and that it is too severe on crisis countries that often gives rise to economic recession. Reflecting the concern of the advanced countries, financial empowerment of the IMF has been deliberately stalled. At least, such a decision has been postponed

till the progress on SDRM/PSI becomes clearly visible. The argument suggests that a stronger crisis prevention architecture would reduce the need for an ILOLR. The experience of the emerging markets, in turn, suggests that inter-bank markets do not allocate international liquidity as per the liquidity needs of countries, and that contagion and uncertain behaviour of private markets that often give rise to rush for exit entail large costs for the countries that participate in the process of globalisation. An ILOLR can make the globalisation process smoother and less painful, even if that gives rise to the problem of moral hazard. Despite the risk of moral hazard, every country has its own national LOLR. In the international context, the ILOLR has to necessarily operate through the national LOLRs while providing the liquidity support, and it should be up to the national LOLRs to address the liquidity problems of national financial institutions. Unlike the constructive ambiguity that characterises national LOLRs, the policies of the ILOLR, however, should be transparent so as to avoid the scope for misuse arising from unfair discrimination of countries.

Initiatives that can strengthen the global crisis prevention and resolution architecture, such as SDRM/PSI, stronger Fund surveillance, private Contingent Credit Lines, declaration of Fund approved standstills, market friendly measures such as transparency and compliance with international standards and codes, and even appropriate exchange rate regimes and domestic safety nets should not be viewed as a substitute of an ILOLR; instead, the ILOLR should continue to have a role irrespective of the degree of progress on these initiatives. The IMF has already assumed the role of an ILOLR, and at times it has lent even to countries which are clearly identified as insolvent due to their unsustainable debt, such as the HIPC/PRGF countries. Lending under the SRF is not constrained by any access limit and such financing is also provided more quickly and at a penal rate. IMF lends against policy and conditionality serves the role of collateral. Irrespective of a country's performance under conditionality, IMF obligations are always paid back and, in that sense, the implications of a default on Fund liability represent the best form of collateral against which the IMF can lend freely. Its capacity to lend freely, however, is constrained by its limited resources. A few systemically important emerging markets can

take the IMF to the point of exhaustion if they together approach the Fund for assistance. The present policy of highlighting the current comfortable liquidity ratio as the indicator of adequate availability of resources with the Fund clearly disregards the potential for sudden spurt in demand that may arise in the eventuality of sustained and simultaneous crises in several systemically important emerging market economies.

References:

Bagehot, W. (1873), " Lombard Street – A Description of the Money Market", John Wiley and Sons, Inc. (New Edition in 1999).

Bordo, M.D. (1990), " The Lender of Last Resort: Alternative Views and Historical Experience", *Federal Reserve Bank of Richmond Economic Review,* Jan./Feb.

Calomiris, Charles W. (1998), " The IMF's Imprudent Role as Lender of Last Resort", *The Cato Journal,* Vol.17, No.3.

Fischer, Stanley (1999), "On the Need for an International Lender of Last Resort" Speech delivered at the Joint Luncheon of the American Economic Association and the American Finance Association, New York, January 03.

Frankel, Jeffrey A. (1999), " International Lender of Last Resort", paper presented at the conference on Rethinking the International Monetary System, *Federal Reserve Bank of Boston,* June 7-9.

Frenze, Christopher and Robert Keleher (1999), Statement before the International Financial Advisory Commission, September 09.

Frexias, Xavier, Curzio Gianini, Glenn Hoggarth and Farouka Soussa (1999), " Lender of Last Resort: A Review of the Literature", *Bank of England Financial Stability Review,* November.

Giannini, Curzio (1999), " Enemy of None but a Common Friend of All", *Princeton Essays in International Finance,* No. 214, June.

Goodfriend, M. and J.M. Lacker (1999), " Limited Commitment and Central Bank Lending", *Federal Reserve Bank of Richmond Working Paper.*

Goodhart, Charles A.E. and Haizhou Huang (2000), " A simple Model of an International Lender of Last Resort", *IMF Working Paper WP/00/75,* April.

Guttentag, J. and R. Herring (1983), " The Lender of Last Resort Function in an International Context", *Princeton Essays in International Finance,* No. 151, May.

Herrala, Risto (2001), " An Assessment of Alternative Lender of Last Resort Schemes", *Bank of Finland Discussion Papers*, No.1

Humphrey, Thomas (1975), " The Classical Concept of the Lender of Last Resort", *Federal Reserve Bank of Richmond Economic Review*, Vol. 61.

Jalan, Bimal (1999), " Interim Committee Statement", IMF, April 27.

Kindleberger, C. (1989), " Manias, Panics, and Crashes: A History of Financial Crises", Basic Books, New York.

Litschig, Stephen (2001), " Blueprint for an International Lender of Last Resort: An Assessment", *Graduate Institute of International Studies*, November 27.

Mann, Catherine L.(1998), " An International Lender of Last Resort and the International Financial Markets", *Institute for International Economics*, April.

Mishkin, Frederic S. (2000), " The International Lender of Last Resort: What are the Issues?", paper presented at the Keil conference on the "World's New Financial Landscape: Challenges for Economic Policy", June 19-20.

Niskanen, Mikko (2002), " Lender of Last Resort and the Moral Hazard Problem", *Bank of Finland Discussion Papers*, No. 17.

Pattanaik, Sitikantha and Sangita Misra (2002), " The Spectre of IMF Conditionality: Some Streamlining Options", *The Indian Economic Journal*, Vol.50, No.1.

Rochet, Jean-Charles and Xavier Vives (2002), " Coordination Failures and the Lender of Last Resort: Was Bagehot Right After All?", *FMG Discussion Paper DP0408*, Financial Markets Group.

Rogoff, Kenneth (1999), " International Institutions for Reducing Global Financial Instability", *Journal of Economic Perspectives*, Vol. 13.

Sachs, Jeffrey D. (1999), " The International Lender of Last Resort: What are the Alternatives?", paper presented at the Conference on Rethinking the International Monetary System, *Federal Reserve Bank of Boston*, June 7-9.

Saxton, Jim (1999), " An International Lender of Last Resort, the IMF, and the Federal Reserve", Joint Economic Committee Study.

Schwartz, A.J. (1997), " From Obscurity to Notoriety: A Biography of the Exchange Stabilization Fund", *Journal of Money, Credit and Banking*, No.29, May.

Schwartz, A.J. (1999), " Is There a Need for an International Lender of Last Resort?", NBER, Shadow Open Market Committee, March.

Thornton, H (1802), " An Enquiry into the Nature and Effects of the Paper Credit of Great Britain".

Tietmeyer, Hans (1999), " Systemic Risk and Lender of Last Resort Facilities", Speech delivered at the *Center for Financial Studies*, June 11.

Wyplosz, C. and O. Jeanne (2001), " The International Lender of Last Resort: How Large is Large Enough?", *NBER Working Paper* No. 8381, July.

Reserve Bank of India Occasional Papers
Vol.22, Nos.1, 2 and 3, Summer, Monsoon and Winter, 2001

Agricultural Marketing in India: Problems and Prospects

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Since the existing agricultural marketing system in India was developed in the context of a planned economy, a fresh approach to marketing is necessary in the liberalised and globalised atmosphere. The National Agriculture Policy also envisages the need for a new demand driven set up catering to domestic as well as export markets. The promotion of an efficient marketing system is, therefore, necessary for expediting agricultural growth in India. In this context, this study attempts to analyse the state of present marketing system, examine alternative marketing options and suggest ways to develop a vibrant agricultural marketing system in India to meet the emerging situation.

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Introduction

Agriculture has a vital place in the economic development of the country as it contributes about 22 per cent of the gross domestic product (GDP) and employs about 65 per cent of the workforce. In any design of economic development, the development of agriculture has to be an integral part. Marketing is as critical to better performance of agriculture as farming itself. Although a considerable progress has been achieved in technological improvements in agriculture by the use of irrigation facilities, high-yielding variety seeds, chemical fertilisers and plant protection measures, the rate of growth in farming has not attained the expected levels. This has been largely attributed to the fact that not enough attention has been paid to marketing facilities and services. Therefore, marketing reforms ought to be an integral part of the national policy for agricultural development. In this context, this study attempts to analyse the current state of existing agricultural marketing system and its efficiency, examine alternative marketing options and their suitability, and suggest ways and means to promote an effective, efficient and integrated agricultural marketing system in India.

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The study has been organised into four sections. Section I presents an overview of agricultural marketing in India, while Section II analyses the current state of agricultural marketing system. Section III highlights emerging strategies including alternative marketing options and Section IV contains the concluding observations.

Section I

Overview of Agricultural Marketing in India

Agricultural marketing, essentially being a sub-set of the overall marketing system, refers to all the activities, agencies and policies involved in the procurement of farm inputs by the farmers and the movement of agricultural produce from the farms to the consumers/ manufacturers/ exporters. An efficient marketing system minimises costs and maximises benefits to all the sections of the society. It ought to provide remunerative prices to the farmer, food of the required quality at reasonable prices to the consumers and adequate margins to the middlemen so that they remain in the trade.

In India, the importance of an efficient marketing system as a vital link between the farmer and the consumer was recognised way back in 1928 by the Royal Commission on Agriculture (Acharya, 1996). Since then, a good deal of progress has been made in organising agricultural marketing by adoption of various administrative and legislative measures from time to time. The establishment of the Directorate of Marketing and Inspection in 1935, the enactment of the Act for grading and marking of agricultural produce in 1937, the conduct of commodity market surveys and the establishment of regulated markets in the States under the Agricultural Produce Marketing Regulations Acts are some of the measures which were taken up before independence to improve the marketing situation.

After independence, three major sets of inter-dependent policies and programmes were pursued for the development of agricultural marketing in India. These were: the creation of infrastructure (both physical and institutional), the implementation of price stabilisation policy and the approach to foreign trade in agricultural products. Intervention through creation of infrastructure facilitates the

performance of various marketing functions. For example, the Warehousing Corporations Act, 1962 and the National Grid of Rural Godowns Scheme of 1979 enabled the Central and State Warehousing Corporations to construct warehouses for storage of agricultural crops. The Cold Storage Order, 1980 helped in expanding cold storage facility for preserving perishable agricultural commodities such as fruits and vegetables. Similarly, Forward Contracts (Regulation) Act, 1952; Prevention of Food Adulteration Act, 1954; Essential Commodities Act, 1955; Export (Quality Control & Inspection) Act, 1963; Standards of Weights and Measures Act, 1976; Consumer Protection Act, 1986; and Bureau of Indian Standards Act, 1986 were enacted and a number of apex institutions and organisations such as Central Warehousing Corporation (CWC), Food Corporation of India (FCI), Agricultural Price Commission (later on renamed as Commission for Agricultural Costs and Prices), National Co-operative Development Corporation (NCDC), National Co-operative Marketing Federation (NAFED), State Trading Corporation (STC), Agricultural and Processed Foods Export Development Authority (APEDA), Marine Products Export Development Authority (MPEDA), National Dairy Development Board (NDDB), National Horticulture Board (NHB), Spices Board, National Institute of Agricultural Marketing (NIAM), *etc.* were set up for facilitating various marketing functions. In pursuance of the price stabilisation policy, the State intervenes directly in the market through various State agencies for the purpose of procurement and distribution. In respect of 22 items, the Government announces the minimum support prices (MSP) at which the State agencies would make purchases (GOI, 2003). The Commission for Agricultural Costs and Prices (CACP), the FCI, States' Civil Supply Departments and fair price shops play a pivotal role in implementing the Government's price stabilisation policy.

As for the State's policy towards foreign trade in agriculture is concerned, two phases are visible. Till recently, as a component of inward looking strategy, agricultural policies were largely driven by the objective of achieving self-sufficiency in production and stabilisation of domestic prices. More recently, the emphasis has shifted on generation of surplus for exports in order to increase agricultural exports (GOI, 1995). The objective of the shift in

policy stance is to increase farm income, reduce unemployment, earn foreign exchange and in general, to set the agricultural sector on a higher growth trajectory.

At present, the structure of Indian agricultural marketing system consists of: the Agricultural Co-operative Marketing Societies, the Regulated Markets, the Public Trading and the Futures Trading. Besides, there is private trading, which takes place out of these segments. The agricultural co-operative marketing societies generally undertake marketing of agricultural produce on behalf of the members as also supply of agricultural inputs to them. Moreover, co-operatives have diversified their activities into other areas such as constructing warehouses, providing credit facilities, processing of agro-products, *etc*. The agricultural co-operative marketing is generally featured by a four-tiered structure: the primary marketing societies are at the base level, district/regional federations at the district level, State marketing federations at the State level and National Federation at the apex level. The National Agricultural Co-operative Marketing Federation (NAFED) is the apex co-operative marketing organisation. The regulated markets have been organised in most of the States to facilitate trading in an orderly manner in specified commodities at specified places at the least margin. For this purpose, comprehensive rules have been framed and market committees have been set up to enforce discipline among the participants under the respective State Agricultural Produce Marketing Regulations Acts. The objective of State trading is stabilisation of prices at levels that are regarded as remunerative to producers and reasonable to consumers. Under the present practice, the Government purchases specified commodities at notified procurement prices directly from producers and distributes the purchased items among consumers through a network of fair price shops at notified issue prices.

Futures trading has also been allowed to protect the market participants from the risk arising out of adverse price fluctuations. There is a three-tier regulatory structure for conduct of futures trading. At the base level, there are recognised/ registered commodity associations/ exchanges. At the middle level, there is Forward Markets Commission (FMC), which regulates the functioning of commodity exchanges and approves their constitution and bye-laws. The

Department of Consumer Affairs, Ministry of Consumer Affairs, Food and Public Distribution, Government of India is at the top level, which oversees the overall functioning of the forward and futures markets.

Section II

Current State of Agricultural Marketing System in India

To analyse the current state of agricultural marketing system in India, it is essential to examine the trends in agricultural production and marketed surplus, progress made by various marketing networks in handling the marketed surplus and the efforts made in improving their efficiency and increasing infrastructural facilities therein.

Agricultural Production and Marketed Surplus

In order to assess the adequacy of agricultural marketing infrastructure in the country, it is imperative to estimate the marketed surplus. Generally, there is a positive correlation between production and marketed surplus. In the past 30 years, while the production of foodgrains and non-foodgrains has approximately doubled, the production of vegetables, fruits, flowers and spices has risen even faster in response to the changing consumption pattern of the population. According to an estimate, the production of potatoes has multiplied by 12 times over the past three decades (Mohan, 2002). The marketed surplus has also gone up in tandem or even faster with the rise in production of foodgrains, non-foodgrains, vegetables, fruits, flowers and spices. For example, the procurement of rice and wheat by the public procurement agencies has increased by 5 times over the past 30 years. Marketed surplus indeed is a function of many factors - type of crop, nature of farming and size of holding. The marketed surplus is almost hundred per cent in respect of commercial crops such as cotton, jute, cashewnuts and black pepper. On the other hand, marketed surplus was as low as 18.2 per cent in respect of ragi (GOI, 1995a). This necessarily implies that the estimate of marketed surplus would have to be commodity-specific.

Projections of marketed surplus of various farm products for the year 2006-07 have been made on the basis of the estimates of

marketed surplus - output ratio for the year 1999-2000 in order to examine the adequacy of marketing infrastructure for the future. The marketed surplus of all cereals taken together would rise from 89.90 million tonnes in 1999-2000 to 102.74 million tonnes in 2006-07. As regards pulses, the marketed surplus is expected to rise from 9.77 million tonnes in 1999-2000 to 15.20 million tonnes in 2006-07 (Kumar and Mathur, 1996 and GOI, 2001a). Similarly, the marketed surplus of non-foodgrains, fruits, vegetables, flowers and spices is also likely to go up substantially in 2006-07 from the production level in 1999-2000. The export and import of agricultural commodities are also expected to rise significantly as per the present indications. Thus the marketed surplus, which the marketing system would be required to handle in 2006-07, would be about 15-20 per cent larger as compared to the levels prevailing in 1999-2000. The existing marketing infrastructure is barely adequate to meet the present marketing requirements. Larger and better-equipped marketing infrastructure would therefore be required for handling larger quantum of market surplus in 2006-07.

Marketing Networks

In India, the formal marketing networks consist of agricultural co-operative marketing societies, regulated markets, State trading and futures trading as discussed earlier. The produce marketed through agricultural co-operative marketing societies accounts for about 8 to 10 per cent of the marketed surplus. The important commodities marketed by these societies are foodgrains, sugarcane, cotton, oilseeds, fruits, vegetables and plantation crops. The progress of co-operative marketing societies has varied from State to State and within each State from commodity to commodity. Maharashtra, Uttar Pradesh, Gujarat, Punjab, Haryana, Karnataka and Tamil Nadu together account for more than 80 per cent of the total agricultural produce marketed through co-operatives in the country. In Punjab, Maharashtra, Uttar Pradesh, Andhra Pradesh and Tamil Nadu, 75 per cent of the foodgrains are marketed by co-operative societies. In Maharashtra and Uttar Pradesh, 75 per cent of sugarcane, in Maharashtra and Gujarat, 75 per cent of cotton, and in Karnataka 84 per cent of plantation crops are marketed through the co-operative societies (Rangarajan, 1997).

The progress of co-operative marketing societies has been far from satisfactory in most of the States in the country because farmer members do not patronise these societies for the sale of their produce. Instead they use the services of commission agents in the regulated markets for various reasons such as easy access to commission agents, facility of advance loan, hassle free transactions and personalised services rendered by commission agents. State intervention through its nominated officials (Secretaries) and politicisation of these societies had also been responsible for their failure.

Though the establishment of regulated markets was started during 1930s, the programme got momentum only after independence. The number of regulated markets has risen from 236 in April 1951 to 7,161 in March 2001. Nearly 98 per cent of the wholesale markets are now functioning under this scheme. The country also has 27,294 rural periodical markets as on March 2001, about 15 per cent of which function under the ambit of regulated markets (GOI, 2001a). The progress of regulated markets is not uniform in all the States. There is appreciable growth in the number of regulated markets in the States of Andhra Pradesh, Bihar, Gujarat, Haryana, Karnataka, Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, Tamilnadu, Uttar Pradesh and West Bengal. The growth of regulated markets is moderate in the States of Assam, Goa, Himachal Pradesh and Tripura. Market regulation has not been enforced in eight States (Arunachal Pradesh, Jammu and Kashmir, Kerala, Manipur, Meghalaya, Mizoram, Nagaland and Sikkim). The average area served by a regulated market varies from State to State. It varies from 1200 sq. km. in Orissa to 76 sq. km. in Punjab (GOI, 2003). The number of commodities under regulation also varies from State to State, but they include almost all the important commodities such as foodgrains, oilseeds, fibre crops, commercial crops, fruits and vegetables. There are also variations across States in the development of infrastructural facilities as well as market fees charged in the regulated markets.

The number of regulated markets and the infrastructural facilities therein are by and large inadequate to meet the current marketing requirements. While regulated markets have helped in mitigating

the market handicaps of the producers/sellers at the wholesale level, the rural periodic markets in general and the tribal markets in particular remained out of its developmental ambit. Thus, the institution of regulated market has achieved a limited success. The restrictive legal provisions did not augur well with competitive market structure. Funds meant for providing and maintaining marketing facilities have been siphoned off in many States from the Agricultural Marketing Board to the public ledger account. Consequently, the modernisation/ development of infrastructural facilities conducive to operational efficiency of the markets suffered heavily.

The price stablisation policy of the Government can be described as a well-conceived package, if we take the objectives, the instruments and terms of reference of the price-recommending expert body, *i.e.*, CACP into consideration. The price components bear upon production (minimum support price), securing surpluses (procurement prices) and distribution or meeting the needs of consumers (issue prices). The procurement agencies, the fair price shops, buffer stock operations and imports, when necessary, back the implementation of the price stabilisation policy. Thus seen as a whole, these seem to be a well-set design of the price stabilisation policy. However, as for the achievement in terms of price stabilisation is concerned, the success has not been as expected. The short-term prices have been fluctuating because of random impact on supply. Generally, these are at the lowest at the time of harvest and the highest before the next crop is harvested. In case of rice, jowar, bajra and groundnut, a major proportion (55 to 74 per cent) is sold within six months of the harvest. Quite a substantial part of this consists of distress sale. In the case of certain crops like wheat, there is, however, moderation of fluctuations, partly because the producers being rich have holding power and access to credit/ storage facilities and partly because of the operations of the procurement agencies (Rangarajan, 1997). The increases in the minimum support price of wheat and rice have been pronounced, which led to increasing cultivation of wheat and rice and in turn contributed to the rise in the procurement of foodgrains. Annual procurement of rice and wheat had averaged 21.9 million tonnes during 1991-97 (GOI, 2002a). This has increased in every successive year since then from 25.4 million tonnes in 1997-98 to 35 million tonnes in

2000-01 and further to 42 million tonnes in 2001-02. The increasing procurement, coupled with declining off-take, had raised the level of food stocks to 65 million tonnes in 2001-02 as against the buffer stock norms of 16-24 million tonnes (GOI, 2003). The cost of operations of the procurement agencies has therefore gone up substantially and the open-ended procurement by these agencies has become unsustainable.

Till 1991, futures trading was permitted in only 6 commodities. The process of reform was set in motion with the setting up of Kabra Committee, which submitted its report in 1994. Since then, several measures have been initiated in a phased manner to promote futures markets in the country. But the pace of reforms has so far been slow and cautious. At present, futures trading is permitted in 42 commodities under the auspices of 19 commodity exchanges. In addition, 10 commodity exchanges have been granted in-principle approval. Further, two commodity exchanges *viz.* Online Commodity Exchange of India Ltd. (OCEIL), Ahmedabad and National Board of Trade (NBOT) have been identified as exchanges having "National Status", implying that these exchanges would be automatically permitted to conduct futures trading in all approved commodities, subject to clearance of bye-laws and contract specifications by the FMC. While OCEIL has been given final approval in this regard, NBOT has been accorded in-principal approval for setting up a nation-wide commodity exchange (GOI, 2003).

In general, the commodity exchanges are deficient in several aspects such as infrastructure, logistic, organisational structure, management, linkages with spot markets and financial markets, reliability and an efficient market information system. Of late, the number of active members and the volume of trade in most of the commodity exchanges had been shrinking. Setting up of screen-based online trading, warehouse receipt system, guarantee fund, electronic clearinghouse and settlement system, *etc.* has not found favour with most of the commodity exchanges so far. The resource crunch has, no doubt, been the major constraint facing most of the exchanges in undertaking these reforms. In a nutshell, the commodity futures markets in India continue to be underdeveloped and separated from spot markets.

Infrastructural Facilities

With the rise in agricultural production and marketed surplus, impressive growth was recorded in the development of infrastructural facilities for marketing as well. The transport sector had expanded fast. The road length, in particular modern surface roads, had increased at a fast rate. Similarly, the total covered storage capacity of the Food Corporation of India, Central Warehousing Corporation and the State Warehousing Corporations rose from 3.6 lakh tonnes in 1960-61 to 26.4 million tonnes in 2001. In addition, the storage capacity of around 25.3 million tonnes is available with public, private and co-operative sectors (GOI, 2001a). However, in the background of over 200 million tonnes of foodgrains production, the available storage capacity is quite inadequate. The cold storage capacity has multiplied by many times from 359 cold storage units with 3.1 lakh tonnes capacity in 1960 to 4,199 units with 153.85 lakh tonnes capacity by end-March 2001, but it is also inadequate to meet the present requirements. It is sufficient only for about 10 per cent of the total production of fruits, vegetables and other perishable commodities (GOI, 2001a). Grading and marking of agricultural products also went up substantially. During the year 2000-01, 163 agricultural commodities were graded and marked under AGMARK for export purposes. There are 23 laboratories and 43 offices spread across the country to keep check on the quality of certified products (GOI, 2002b). Processing, packaging, extension services, research and dissemination of market information have also registered impressive growth over the past few years. However, the infrastructural facilities developed so far are not adequate to meet the present marketing requirements. About half of the villages in the country are still not connected to the market place by all weather roads. The rail transport suffers from shortages of wagon capacity and congestion on trunk routes. The present storage capacity for foodgrains, non-foodgrains, fruits and vegetables is inadequate, resulting in lot of wastages every year. Processing of agricultural products especially perishable commodities forms only a small percentage of the total production. In case of fruits and vegetables, only one per cent of the production is processed in India as against 83 per cent, 78 per cent and 70 per cent of the total production in countries like Malaysia, Philippines and Brazil, respectively (Rangarajan, 1997).

Marketing Efficiency

Marketing efficiency is essentially the degree of market performance. Broadly, one may look at efficiency of a market structure as to whether it fulfills the objectives assigned to it at minimum possible cost or maximises the fulfillment of objectives with a given level of resources. Thus the objectives assigned to the system are of critical importance in assessing the marketing efficiency. An ideal agricultural marketing system should ensure remunerative prices to the producers, uninterrupted supply of goods at cheaper prices to the consumers and the accumulation of surplus for further development (Subbarao, 1996). An efficient market should, therefore, ensure 'operational efficiency' as well as 'distributive efficiency'. Operational efficiency ensures the availability of the product at all places at the same price subject to adjustment for transport costs, storage costs and quality differences. Distributive efficiency is obtained when all the producers get the same price subject to the quality of the produce and all the buyers pay the same price subject, again, to the quality of the product.

Measurement of market efficiency at the national level is extremely difficult due to a variety of factors. To be meaningful, the concept has to be, in fact, crop-specific and location-specific. The available evidence suggests that the degree of efficiency of the Indian foodgrain markets vary from location to location within the country. In respect of perishables, oilseeds and pulses, no tangible benefit had accrued to both producers and consumers. In general, the unit marketing costs of these items have remained stable and, at any rate, have not shown any tendency to decline. On the contrary, according to certain studies in some locations, the share of the intermediaries had risen (Swarup, *et. al*., 1985; Tilekar, 1980; Desai, 1985; Sinha, and Prasad, 1985; Prasad, *et.al*., 1985). In certain instances, the producers' share was lower at regulated markets as compared with that in unregulated markets (Subbarao, 1986; Ajjan, 1986). There could be several reasons to account for this phenomenon: i) The active participation of State agencies in the procurement was found to be often not timely and usually limited; ii) The farmers were under compulsion to sell the products quickly in the open markets where monopolistic conditions were often found to be strong; and iii) The prevalence of high levy charges in regulated markets had

also contributed to the sale of products by farmers at lower prices. According to another estimate, the farm-gate prices for vegetables and fruits range between 20-30 per cent of the eventual retail prices in India. In developed countries, such as the USA, the UK and Japan, the farm-gate prices for such products range between 40-55 per cent of retail prices (Mohan, 2002). This is because of various restrictions that currently inhibit farmers from selling their products freely. The consequence of the existing controls is proliferation of intermediaries between the farmer and the consumer, which in turn, results in higher transportation, storage and distribution costs of agricultural products.

To ensure uninterrupted supply of goods at reasonable prices to consumers, there should be stability in prices. Stability in prices would require that variations in prices between seasons and regions are minimal. As for inter-seasonal variations in prices, a Food and Agricultural Organisation (FAO) Study showed that, during 1968 to 1985, the differences in the prices that prevailed during the peak harvesting seasons and the lean months were very high in respect of both wheat and rice. The differences were so high that they could not be explained by carrying costs. However, when a range was taken by using mean prices during the peak and lean seasons, the percentage variation was found to be less than that warranted by the carrying costs. This variation tended to decline after 1974-75 due probably to the creation of buffer stock by the Food Corporation of India. With regard to the inter-regional price dispersion, it was found to decline for both wheat and rice after 1974-75, but the trend was characterised by large year-to-year fluctuations (Bhalla, 1996). In the recent past, the public procurement agencies procured about 15-20 per cent of total production of wheat and 12-15 per cent of rice under their open-ended procurement policy. These buffer stock operations had the desired impact on the stability of prices of rice and wheat.

To ensure marketing efficiency, it is necessary that the cost of marketing should be minimal. Studies on the cost of marketing reveal that there is a large variation in the cost per unit. The factors which affect marketing costs are: perishability of the product, extent of loss in storage and transportation, volume of the product

handled, regularity in the supply of the produce, extent of packaging, extent of adoption of grading, necessity of demand creation, bulkiness of the product, need for retailing, extent of price and demand risk, marketing facilities extended by the dealer to the consumers such as free home delivery, credit facility, *etc*. The cost of marketing of agricultural commodities is generally higher than that of manufactured products because of widely dispersed farms and small output per farm, bulkiness of agricultural products, difficulty in grading, irregular supply, greater need for storage and processing, long chain of middlemen, higher risk of price fluctuation, *etc*.

The marketing cost of foodgrains in India is lower than in developed countries. It is mainly because of two reasons: i) foodgrains are sold in a relatively unprocessed form in India, while in developed countries, consumers want them mostly in processed form; ii) human labour (a component of marketing cost) is relatively cheap in India than in the developed countries. However, over time, there has been an increase in the marketing cost in India too. Some of the factors which have been responsible for this increase are: shift from subsistence to commercialised farming, technological advances in preservation and storage, change in the form of consumer demand, multiplicity of taxes, poor infrastructure which increases costs and puts barriers to entry and competition, *etc*.

The most comprehensive study of the FCI's operations and its costs was made by Bureau of Industrial Costs and Prices (BICP) in 1991. More recently, in 2001, the Administrative Staff College of India (ASCI) has carried out a study on costs of acquisition and distribution of the FCI. BICP study found that FCI costs of procurement and distribution had increased more than the overall price level and much more than the purchase price of grains during 1980s. However, it also found that most of the excess cost increase was because of factors beyond FCI control, particularly statutory levies at the procurement stage and railway freight rates. Nonetheless, BICP identified several important areas in which controllable costs were excessive and could have been reduced. These were opening of procurement centers and staffing of these, excessive railway movement compared to purchase and final distribution, and storage practices which caused avoidable costs and storage losses. ASCI

reports that though FCI's economic cost of wheat has declined as percentage of minimum support price during 1990s and this has remained roughly constant for rice, it is a failure of sorts that FCI has not reduced costs further given improved communication and transport and also that FCI's economic cost in 2000 was higher than market prices. ASCI has also identified areas for cost reduction, but almost all of these involve items beyond FCI control and require change in Government policy. The Committee on Long-Term Grain Policy has evaluated the BICP and ASCI conclusions in conjunction with other estimates of FCI's cost relative to the private trade. There are some studies which show somewhat lower costs (5 to 20 per cent) of private trade than FCI in primary trade. This appears to be mainly on account of lower labour costs in private trade *vis-à-vis* FCI. However, a few studies available show higher storage losses in the private trade, which also incurs higher distribution costs, *i.e.*, transport costs and higher trading margins at various levels (GOI, 2002a). In a nutshell, there is scope to reduce the cost of operations of FCI by transferring some of its functions to other Central/ State agencies or the private sector in which it is less efficient than these agencies. For example, storage cost of foodgrains is lesser in case of Central Warehousing Corporation and State Warehousing Corporations than FCI.

Thus the strategies followed so far have undoubtedly helped in achieving self-sufficiency in foodgrains, increasing the production of oilseeds and other cash crops, reducing intra-year price fluctuations, stabilising returns to the farmers, improving market efficiency in some crops and building up a broad-based institutional infrastructure for marketing of agricultural produce. Notwithstanding these quantitative and qualitative improvements, several weaknesses in the agricultural marketing system, as discussed above, still persist. The restrictions on trading, storage, processing, pricing and movement of agricultural commodities still continue to hamper directly or indirectly the orderly growth of agricultural marketing in India. The end result is the imperfections in the marketing system, unmanageable State trading operations, seasonal variations in prices and stagnation in agricultural growth rates.

Section III

Emerging Strategies

The economic reforms that are currently underway in India encompass the agricultural marketing system as well. The essence of these measures is to improve the efficiency and productivity of all institutions whose working is far from satisfactory. Against this background, it is necessary to see the lacunae that have arisen in the agricultural marketing system and initiate measures to correct the same. As the production technology and the post harvest technology change, there has to be a consequential change in the marketing technology as well. There cannot be a hiatus between the two. The agricultural production base is getting diversified and the process of commercialisation of agriculture will gather further momentum in the coming years. Apart from the production of foodgrains and commercial crops, horticulture and floriculture are emerging as important components. Production of fruits, vegetables and flowers will assume increasing importance in the production system. In case of fruits and vegetables because of their perishable nature, there will be a considerable loss unless the marketing technology is suitably modified. While in case of cereal, pulses and sugarcane, the loss by storage is estimated between 5-20 per cent, in the case of fruits and vegetables, it is estimated between 25-30 per cent (Rangarajan, 1997). Apart from the pricing policy, which has several macro economic implications, the evolving strategy for agricultural marketing must emphasise the following:

Integration of Domestic Markets with International Markets

The domestic markets, particularly for foodgrains, should be the whole country. This calls for dismantling of restrictions on pricing, trading, distribution and movement of agricultural products within the country. A review of all laws which regulate participation in market such as registration/licensing, laws affecting market place, laws relating to access to credit and capital, dispute resolution mechanism, *etc*. also needs to be undertaken in order to make them conducive for free play of market forces.The Government of India has already reviewed the operation of the Essential Commodities Act, 1955, while the restrictive orders inhibiting storage, selling

and movement of food and agricultural products are currently under review. To carry this process forward, the States should also initiate appropriate measures to remove all restrictions on agricultural marketing on similar lines. Further, India, being a signatory to the World Trade Organisation (WTO) Agreement, should do away with physical barriers, both for imports and exports, on various agricultural commodities. Simultaneously, it should reduce tariff barriers within a time frame. These steps could facilitate the integration of domestic markets with international markets in due course.

Strengthening Co-operative Marketing Societies

The progress made by co-operative marketing societies so far, though noteworthy, is not wholly satisfactory. Co-operatives have yet to cover a substantial part of the total agricultural produce. It is, therefore, essential that these co-operatives develop at a faster speed and along right lines. Marketing societies need to be more closely intertwined with other societies dealing with farming inputs, credit, *etc*. The best way to do so is to establish multipurpose societies to look after all the aspects of agricultural marketing. These societies, apart from organising the sale of agricultural produce, should undertake construction of their own storage capacity, provide for their own transport, arrange for the processing of produce, grade their goods, organise exports, *etc*. This will reduce their dependence on other sources and provide a total view of marketing services to the members.

Strengthening Regulated Market Structure

The management of regulated markets is entrusted to agricultural produce marketing committees (APMC) on which different interests are represented. There is an urgent need to make these market committees viable and managerially competent in keeping with liberalised trade atmosphere. The market committees should be headed either by professionals or the existing Secretaries should be trained in professional management of markets. The functions of market committees and marketing boards may also have to be remodeled accordingly. Further, the present number of regulated markets is not enough to meet the growing requirements of the country. It has been estimated that the country needs 12,000 to

14,000 additional market yards. Further, development of infrastructure within spot markets and other places is a huge task involving an estimated investment of Rs. 6,026 crore (GOI, 2001a). Since the States are not in position to mobilise resources of this order, the private sector investment backed up with suitable package of incentives needs to be encouraged. However, the public sector should continue playing its role in providing infrastructure in remote and difficult areas and overall market regulation.

There is also an urgent need to develop rural periodic markets in a phased manner with necessary infrastructural amenities to have a strong grass-root level link in the marketing chain. The investment requirement for developing these market places is estimated at Rs. 2,146 crore (GOI, 2001a). There is also a need for developing specialised markets for fruits and vegetables, flowers, cattle, *etc.* It has been assessed that there are at least 241 such places in the country where fruits and vegetables markets could be developed. The investment requirement for these markets is around Rs. 970 crore (GOI, 2001a). Besides, there is an urgent need to turn these markets into growth centers of farming community.

Re-framing Price Stabilisation Policy

With a view to provide remunerative price to the farmer, food at affordable price to the consumer and sustained growth of marketable surplus, all undesirable restrictions on agricultural trade has to be removed. Public procurement, storage and distribution of foodgrains need to be managed efficiently and on commercial lines. Once commodity futures markets become fully operational, the role and involvement of public procurement agencies should be minimised.

The current situation of open-ended procurement by Food Corporation of India at a high price and disposal at a heavily subsidised price is not sustainable. In this regard, the "Report on Long Term Grain Policy, 2002" recommends that India must continue to plan for cereals self-sufficiency. This is of strategic necessity since India accounts for 15 per cent of total world consumption of cereals and since world production and trade is highly distorted by policies of rich countries. These countries are subsidising grain production heavily at present, but may push up prices if they acquire monopoly in world trade. However, it is necessary to supplement

the MSP policy with other measures to make it sustainable, *e.g.*, market-based insurance against price and income fluctuation and a system of negotiable warehouse receipts. Then there is considerable scope to improve FCI's performance to lower its costs of operations and most importantly to raise the quality of grains it supplies.

Further, the export and import policies for agricultural commodities need to be clear-cut and should remain stable over a sufficiently long period of time. Barring exceptional cases such as coping with emergencies, it is advisable to move towards a system wherein exports and imports of agricultural produce are freely allowed and any well-defined interest to be safeguarded is achieved by an appropriate import or export duty. These measures could go a long way in stabilising prices of agricultural produce.

Developing Efficient Commodity Futures Markets

Since the Government's acceptance of the recommendations of the Kabra Committee, 1994, efforts have been made to allow futures trading in more commodities, set up more commodity exchanges, improve the regulatory and supervisory systems, modernise clearinghouse operations, upgrade training facilities and establish an enabling legal framework to develop vibrant commodity futures market in India. But, the pace of reforms has been very cautious and slow. Much more concerted efforts need to be made to accomplish the task fully. Removal of a number of deficiencies that still persist is a formidable challenge before the Government, the FMC and the commodity exchanges. In this context, the removal of price and distribution controls, development of competitive cash markets, provision of an enabling legal framework, demutualisation and restructuring of the existing commodity exchanges, setting up of multi-commodity exchanges and strengthening the FMC should be accorded priority.

Promoting Direct Marketing

Promotion of direct marketing as one of the alternative marketing structures is beneficial for the farmers as well as the buyers as it enables the former to meet the specific requirements of the latter. Direct marketing enables farmers and buyers to economise on

transportation costs, handling charges, market fees, *etc.*, to improve price realisation considerably. In direct marketing, the market will operate outside the purview of Agricultural Produce Marketing Act and will be owned by professional agencies, such as wholesalers, trade associations, farmers associations, companies, *etc.* in the private sector or through Self-Help Groups (SHGs), informal groups, co-operatives, Non-Government Organisations (NGOs), *etc.*, as non-profit organisations free from Government intervention. As a first step in this direction, the State Governments should amend the Agricultural Produce Marketing Acts to enable farmers to sell directly to potential processors. As a second step, a common code of conduct and modalities with regard to ownership, operation and need-based infrastructure will have to be prepared and circulated to spread the concept of direct marketing. As a third step, the Government should support these organisations with schemes such as providing back-ended incentives for refrigerated and general transport, constructing godowns and cold storages, setting up grading and packaging houses, *etc.*

Improving Transport Infrastructure

The traditional rural transport system should be improved by encouraging use of pneumatic tyre in place of wooden and iron wheels and springs in the axle of the cart as also by the development of good all weather roads linking the villages to the markets. The investment requirement for this purpose has been estimated at Rs. 74,000 crore (GOI, 2001a). In this context, it may be noted that the Pradhan Mantri Gram Sadak Yojana (PMGSY) initiated to provide connectivity through all weather roads to all the villages is making some headway. A further allocation of Rs. 2,500 crore has been made for the year 2002-03 over and above Rs. 5,000 crore provided so far (GOI, 2002). To supplement the Centre's efforts, the State Governments, the local bodies and NGOs should also come forward to expedite the process. Improvement in the availability of railway wagons and decongestion at trunk routes is the other area of crucial importance. The Railway Ministry should take necessary and urgent steps in this direction. "Own your wagon" scheme need to be reviewed and modified to popularise it among the users. Development of coastal shipping and inland waterways is another area where lot of initiative and investment is called for.

Improving Storage facility

With the increase in marketed surplus, the need for increased storage facilities will also rise. The requirement of an additional storage capacity to be built during the next decade is estimated at about 20 million tonnes for which an additional investment requirement is estimated at Rs. 5,400 crore (GOI, 2001a). The private sector needs to be encouraged to enter the warehousing and storage in a big way by extending proper incentives to it. The experiment of the creation of decentralised rural godowns also needs to be pursued more vigorously. Village Panchayats, co-operatives, SHGs, farmers organisations, NGOs, *etc.,* should also be encouraged to undertake warehousing activity under the scheme. In case of perishable commodities like fruits, vegetables and flowers, the complete cold chain comprising pre-cooling, grading, packaging, cold storage and refrigerated vans become necessary. Any break at any point may result in heavy loss to the producers. In the next 10 years, 15,000 cold storage units would need an investment of the order of Rs. 27,000 crore (GOI, 2001a). Again, the investment has to come from the private sector with the back up of a package of incentives. In 2000-01, the Government announced a Credit Linked Subsidy Scheme for construction of cold storages. Sanction has already been accorded for creation of 21 lakh tonnes capacity under this scheme. The Union Budget, 2002-03 proposed to allocate Rs. 70 crore of subsidy for 2002-03. The country also requires reefer containers/ vans for transport of perishable items for domestic and export purposes. At present, their availability in the country is negligible as compared to their requirement. At least, 3,000 such vehicles costing Rs. 600 crore will be required in the next decade (GOI, 2001a). Simultaneously, the use of various preservation and temperature management technologies for perishables like irradiation, nitrogen-fill packaging, vacuum packaging, shrimp wrapping and others also need to be encouraged.

Providing Processing, Packaging and Grading Facilities

Considering the rising demand for value added and processed products, there is a need to enhance tshe capacity of the agro-processing sector. Though the Government of India have formulated several schemes of assistance, there is need to popularise these

schemes by creating awareness about the beneficial effects of these schemes. Conscious efforts in the direction of creating infrastructure such as setting up of food laboratories for testing, training centers for skill upgradation, consultancy services for guidance, *etc.*, will augment the value addition and export potential. At present, value addition is estimated at only seven per cent and processing only two per cent of total production. Within next 10 years, there is a need to increase value addition to 35 per cent and processing to at least 10 per cent. Accordingly, the investment potential in value addition and food processing has been estimated at Rs. 1,50,000 crore (GOI, 2001a).

Proper cleaning, grading and packaging of primary products will need greater attention not only in the physical markets, but also in the villages from where produce is brought to the market for sale. Besides, there is need to educate the farmers for proper grading and packaging before they bring the produce to the market. In the changed context, new technologies of packing like tetra packs, ascetic packing, retortable pouches, *etc.* need to be introduced.

With a view to taking advantage of the liberalised international environment, there is need to encourage export of high value non-traditional products grown in various parts of the country. The Ministry of Commerce has launched a scheme of creating Export-Oriented Agri-Zones (EOAZ). While private entrepreneurs should make investment in the processing units, the Government should invest in common facilities such as roads, electricity, communication, warehousing, testing laboratories, quality certification, *etc*. An investment of Rs. 200 crore by the public sector and Rs. 400 crore by the private sector for 50 such EOAZs has been estimated (GOI, 2001a). In this context, it may be mentioned that EOAZs are presently being promoted in different States and 15 such Zones have been approved so far (GOI, 2002).

Making Available Credit for Marketing

Provision of credit by the organised financial system to support agricultural marketing has to grow further, though even now, the credit made available by the banking system for the public trading agencies such as Food Corporation of India, Jute Corporation of

India, Cotton Corporation of India, *etc*. is considerable. The total food credit outstanding as on March 28, 2003 was of the order of Rs. 49,398 crore (RBI, 2003). Banks also disburse advances up to Rs. one lakh against pledge/ hypothecation of agricultural produce for a period not exceeding six months to those farmers who have availed crop loans for raising their produce. As compared to this, the credit facility available to private traders and processors for storage of agricultural commodities has remained limited. As the role of the private sector in agricultural marketing is envisaged to increase in the liberalised environment, there is a need to streamline the procedures and systems for collaterals. In this context, certified warehouses and a system of negotiable warehouse receipts could lead to improved credit delivery, better loan recovery and convenience in asset management. The institutionalisation of the warehouse receipt system through the commodity exchanges can yield the best results, in particular, through a national system of electronic warehouse receipts. Moreover, all the credit flows to agricultural marketing should be reckoned as priority sector lending, including banks' financing to wholesalers/ traders in agricultural commodities and inputs in order to provide further incentives to the banking system to lend to this segment.

Improving Market Information System

In India, both official and non-official agencies collect market information. Among non-official agencies, dealers in inputs and trade associations are prominent ones, but their role is limited. The main official agencies collecting market information are the State Marketing Department, the State Agricultural Marketing Boards, the Food Department and the Directorate of Economics and Statistics of the State and Central Governments. Weekly data on market arrivals, sales, prices, *etc*. are collected regularly from a large number of reporting agencies. Data on retail prices are also collected by the Government agencies. Besides, daily prices of important agricultural commodities are broadcasted from all regional stations of All-India Radio and displayed on '*Agmarknet*' portal on the official web-site of the Government of India. The '*Agmarknet*' or 'Agricultural Marketing Information Network' portal has been set up by the Directorate of Marketing and Inspection (DMI) by providing computer connectivity to important markets in the country. Newspapers

also publish commodity prices in major markets. Thus there have been considerable improvements in collection of market information during the past few decades. But, the collected information has no meaning until it is comprehensible and up to date. There should be a standardised system of quoting the prices of different varieties of a commodity per unit, so that the prices may be compared over time and space. The prices announced on All India Radio and TV Channels should be in the local language and should cover more local markets of the area rather than secondary and terminal markets located far from the area. A correct and intelligent interpretation of market information should be made along with the market information. Further, the use of information technology in agri-marketing needs to be encouraged in order to generate and host useful portals, websites, databases, information packages, *etc.,* generic as well as customise for both spot and futures markets.

Promoting Agricultural Marketing Research

There is an urgent need to set up linkages amongst the agricultural research institutions. Regional and other Centres of Indian Council of Agricultural Research (ICAR) and State agricultural universities should be given a mandate for applied research in agricultural marketing. Marketing organisations also need to be encouraged to set apart a certain percentage of their profits/ turnover for marketing research. The probable areas for research and training could be agri-business management, post-harvest management, grading, standardisation, quality assurance, export promotion and information technology. The National Institute of Agricultural Marketing (NIAM) should be further strengthened to undertake applied and operational research in agricultural marketing, impart training to market functionaries and provide consultancy services to the public as well as private organisations engaged in agricultural marketing. It should also co-ordinate and promote regional institutions engaged in agricultural marketing research and training.

Further, conferences, seminars, and workshops should be conducted from time to time on current and relevant issues to facilitate exchange of views among various market functionaries. Researchers should also be enthused and assisted to undertake research on issues of topical interest to agricultural marketing.

Section IV
Conclusion

The agricultural marketing system stands today at a critical stage of its evolution. It needs to meet the growing requirements of farmers, consumers, industry and exports as also of agriculture, which is becoming input-intensive and getting diversified. At the same time, the requirements of the small farmers and poorer sections have also to be met. The National Agriculture Policy, 2000 has postulated an increase in agricultural production of the order of 4 per cent per annum during the Tenth Plan. The scope for exports of agricultural commodities will also expand in the changing world trade environment. If the country is to take full benefit of the expanding domestic and external markets, agricultural marketing must receive adequate emphasis. The long chain of marketing from the producing centres to the ultimate consumers needs improvement at every stage. Efficient marketing can ensure better income for the producers and improved satisfaction to the consumers. In order to improve the efficiency of the marketing system: i) the Government needs to examine all existing laws, regulations, rules, policies and programmes with a view to remove all legal provisions inhibiting free play of market forces in agricultural commodities; ii) the operations of co-operative marketing societies have to be linked with credit, processing and other farming societies either through promoting multi-purpose co-operative societies or through proper co-ordination among the activities of different societies; iii) the regulated markets need to be professionally managed, their number to be appropriately increased and all modern marketing facilities to be provided in the market yards; iv) futures markets in as many commodities as economically feasible and socially desirable have to be made fully functional and the spot markets to be linked with them to get price signals and manage market and price risks; v) direct marketing has to be encouraged as an alternative structure of marketing as it will benefit the farmers as well as the consumers; and vi) the role of the State in agricultural marketing has to be confined to the promotion and regulation of market networks aiming at improving their efficiency.

Further, the development of market infrastructure like all weather link roads, warehouses, godowns, cold storage units, refrigerated vans, grading units, processing and packaging facilities, testing laboratories and market information system is another important area where lot of work has to be done. To improve upon the prevailing situation, it is therefore necessary to take action on three main lines: i) more investments for further additions to the infrastructural facilities; ii) proper maintenance and upgradation of the existing facilities through repair, replacements and technological modernisation; and iii) fuller and more efficient use of the existing facilities. The overall investment requirements for strengthening agricultural marketing infrastructure have been estimated at Rs. 2,68,742 crore for the next decade (GOI, 2001a). The Central and State Governments alone would not be able to mobilise resources of this order. Most of these investments would, therefore, need to come from the private sector. However, complementary investment by the Centre and the States, subsidising a few activities to enable private sector initiatives to attain viability and an active stance by the Central Government in taking some important initiatives for creating a conducive and favourable environment would be required. Simultaneously, adequate institutional credit flow to agricultural marketing, particularly to the private sector, has to be ensured from the banking sector. Moreover, the development of peoples' participatory institutions has to be encouraged for the management and sustainable growth of market infrastructure. In effect, we need to make all concerted efforts to put in place an efficient agricultural marketing system, which can cater to the needs of all segments of society and also contribute in raising sufficient marketable surplus for faster economic development of the country.

References

Acharya, S.S. (1996), Marketing Environment for Farm Products: Emerging Issues and Challenges, in *Vistas in Agricultural Marketing (1987-1996). Vol. I*, Indian Society of Agricultural Marketing, Jaipur.

Ajjan, N. (1986), Regulated Markets in Tamilnadu: A Malady - Remedy Analysis, *Agricultural Situation in India*, September.

Bhalla, G.S. (1996), Some Issues in Agricultural Marketing in India, in *Vistas in Agricultural Marketing (1987-1996), Vol. I*, Indian Society of Agricultural Marketing, Jaipur.

Desai, G. (1985), Rapporteur's Report, *Indian Journal of Agricultural Economics*, XL (3) (July - September).

Government of India (1994), *Report of the Committee on Forward Markets"*, Ministry of Civil Supplies, Consumer Affairs and Public Distribution, New Delhi.

Government of India (1995), *Report of the Task Force on Terms of Trade Between Agricultural and Non-Agricultural Sectors*, New Delhi.

Government of India (1995a), *Economic Survey*, 1995-96, Ministry of Finance.

Government of India (1997), *Economic Survey*, 1997-98, Ministry of Finance.

Government of India (2000), *National Agriculture Policy,* Ministry of Agriculture, July.

Government of India (2001), *Economic Survey*, 2001-02, Ministry of Finance.

Government of India (2001a), *Report of the Expert Committee on Strengthening and Developing of Agricultural Marketing*, Ministry of Agriculture, Department of Agriculture and Co-operation, New Delhi.

Government of India (2002), *Union Budget, 2002-03*, Ministry of Finance.

Government of India (2002a), *Report on Long-Term Grain Policy*, Ministry of Consumer Affairs, Food and Public Distribution, New Delhi.

Government of India (2002b), *Annual Report, 2001-02,* Department of Agriculture & Co-operation, Ministry of Agriculture.

Government of India (2003), The Official Website, *http://agmarknet.nic.in*.

Jain, R.K. (2000), Commodity Futures Markets in India - Challenges Ahead, *Economic Developments in India - Continuing Series: Vol. 22,* Raj Kapila & Uma Kapila, ed., Academic Foundation, New Delhi.

Jalan, Bimal (1997), *India's Economic Policy*, Penguin Books, New Delhi.

Kumar, P. and Mathur, V.C. (1996), Agriculture in Future: Demand – Supply Perspective for the Ninth Five Year Plan, *Economic and Political Weekly*, September 28.

Mishra, G.P. (1993), On the Question of Forced Commercialisation in Agriculture, quoted in Prasad, J. and Prasad, A. (Eds.): *Indian Agricultural Marketing*, Mittal Publications, New Delhi.

Mohan, Rakesh (2002), A Decade After 1991: New Challenges Facing the Indian Economy, *Reserve Bank of India Bulletin*, November.

Prasad, A., *et.al* (1985), Net Price Spread of Paddy/Rice in Regulated and Unregulated Markets, *Indian Journal of Agricultural Economics*, XL (3).

Prasad, J. (1989), *Marketable Surplus and Market Performance*, Mittal Publications, New Delhi.

Patnaik, U. (1975), Contribution to Output and Marketable Surplus of Agricultural Products by Cultivating Groups in India, 1960-61, *Economic and Political Weekly*, Vol.X.No.52, December.

Pavaskar, Madhoo (1994), Commodity Futures - Myths & Realities, *The Economic Times*, March 5, 12 and 19.

Rangarajan, C. (1997), Presidential Address at the XIth National Conference on Agricultural Marketing at Chennai on September 17.

Rao, C H Hanumantha (2003), Reform Agenda for Agriculture, *Economic and Political Weekly*, Februaray 15.

Sinha, S.P. and Prasad, J. (1985), Farmer's Share in Consumer's Rupee in Muzaffarpur, U.P., *Indian Journal of Agricultural Economics*, XL (3).

Reserve Bank of India (2003), *Weekly Statistical Supplement to RBI Bulletin*, April, 12.

Subbarao, K. (1986), *Agricultural Marketing in Indian Agricultural Development since Independence*, Indian Society of Agricultural Economics, Bombay.

Subbarao, K. (1996), An Analysis of Agricultural Marketing Systems, in *Vistas in Agricultural Marketing (1987-1996), Vol. I*, Indian Society of Agricultural Marketing, Jaipur.

Swarup, R. *et.al*. (1985), Price Spread and Marketing Margins for Himachal Apples, *Indian Journal of Agricultural Economics*, XL (3).

Tilkar, S.N. (1980), A Study of Marketing Problems of Farmers in Ratnagiri District, quoted in Subba Rao, K. (1996).

Reserve Bank of India Occasional Papers
Vol.22, Nos.1, 2 and 3, Summer, Monsoon and Winter, 2001

Book Reviews

Asian Economic Recovery: Policy Options for Growth and Stability Edited by Tan Kong Yam, The Institute of Policy Studies, Singapore University Press and World Scientific, Singapore, 2002, pages 300.

Very few economic events other than the Great Depression of 1929 have generated such worldwide interest as the East Asian financial crisis of 1997-99. Not only its sudden emergence in the lands of fiscal rectitude and export competitiveness but also their remarkable recovery in a short span of time have given rise to heated debates on a host of diagnostic issues, opening new horizon and dimension in open economy macroeconomics. The crisis has also left the ardent proponents of free trade defensive and even introspective. For instance, Jagdish Bhagwati has noted in his recent writings that while mutual gains from free trade in goods and services are obvious, they are not so in the case of free capital movements. To the least, the crisis has rendered the causal relation between free capital flow and economic development tenuous. Set against such backdrop, the volume under review, which is a selection of 10 Conference papers presented in June 1999 at the Institute of Policy Studies, Singapore, delineates the lessons and policy options for the post-crisis East Asia in pursuit of growth and stability.

In projecting the scenarios for post-crisis East Asia, Tan Kong Yam identified the improper pricing of the exchange rate risk as the key distortion that led to excessive short-term foreign borrowing and lending which lay at the core of the financial crisis. The post-crisis South East Asia, Yam visualises, could be one burdened by the ballooning foreign and domestic debt, and dominated by the resurgent China and Latin America particularly when Japan, caught in a muddle since long, could no longer be expected to act as a locomotive for the South East Asia. Alternatively, the South East Asia could come out reformed and resurgent. In such a scenario, there could be intense competition for scarce capital to deliver

goods and services to the people by both the democratic and authoritarian regimes in the region. The structural reforms undertaken in sequel would avoid much of the excesses of over-borrowing and over-investment, ensuring a robust recovery of the East Asian countries. In a similar vein, Manu Bhaskaran presented an optimistic scenario for the post-crisis East Asia on the basis of its continuing reform and restructuring even though the pace of such reforms was admittedly slow in some countries characterised by 'crony capitalism'. In his comments, William Overholt disagreed that the exogenous banking crisis was an important trigger. Indeed, the Thai economy and the property markets were headed into a crunch two years before the financial crisis with the asset market bubbles in Japan and the withdrawal of capital from the Asian Markets by Japanese banks. Besides, the competition between China and South East Asia was not viewed to be a zero sum game. As a matter of fact, the East Asian economies displayed remarkable resilience, staging a robust recovery in less than 18 months on the strength of their fundamentals anchored in high domestic saving, export competitiveness and fiscal prudence. This essentially underlines the importance of strong macro-fundamentals (*i.e.,* solvency) even in rendering the liquidity problem short-lived.

In search for a viable exchange rate regime for the East Asia, John Williamson felt that most exchange rate crises including the East Asian one were attributable to the failure to maintain a competitive exchange rate. He felt that a regime of floating exchange rate (free or managed), which was likely to be pursued by the East Asian countries might not be consistent with the objective of restoring high growth. Instead, a crawling band would be suitable to avoid any over-valuation of the domestic currency in the wake of capital inflows. Besides, the East Asian countries should go for pegging to a common basket that reflects their average trade pattern instead of a single currency peg. This would help in maintaining the relative competitiveness position within the East Asian countries and outside, especially in the face of swing in US dollar-yen rate. In their comments, both Donald Brash and Sven Arndt advocated for a clean float as against a pegged exchange rate regime. This would avoid or survive not only speculative attack but would make the

domestic banks hedge the currency risk of foreign borrowing unlike in the pegged exchange rate regime. Besides, the proposed regime of a crawling band or pegging to a common basket demands high discipline on the part of an individual country or countries pegged to a common basket, which is unlikely to be met with. As a matter of fact, the East Asian economies have subsequently switched over to a floating exchange rate system without much hitch. However, in emerging economies like India where the foreign exchange market is yet to attain its depth or maturity, clean float with its attendant fluctuation and exchange rate risk may adversely affect the export oriented or import intensive industries. Possibly a managed float might work better if guided by avoidance of over- (or under-) valuation of the currency and supplemented by market-based restriction on short-term capital flow and central bank intervention without any specific exchange rate target. It is in this context, India's success in exchange rate management stands out.

The East Asian crisis has brought the issue of corporate governance to the fore, so much so that the crisis is often taken to be routed in the culture and practices of business and society aptly labelled as 'crony capitalism'. Here, a change of mindset has been advocated by Mario Antonio Lopez at least in the case of the Philippines. What is required is a clearly defined legal and administrative framework, openness and transparency, integrity and accountability as well as a lean and well-paid bureaucracy. Echoing the concerns of Lopez, Richard Wong in his comments underlined the relevance of a market-oriented corporate governance based on maximising shareholder value in an increasingly globalised world. Wong, however, noted the importance of small and medium sized, family-owned firms in the Asian economic growth and the role of family in resolving the principal-agent problems. In his comments, Dong-Sung Cho noted that corporate governance norms vary from country to country, *e.g.*, focusing on shareholders in the US, various stakeholders in the Europe, employees in Japan, and major shareholders in Korea. In the aftermath of the East Asian crisis, while the American model is widely advocated, learning by doing approach could be a better guide in resolving the key issues. Indeed, the corporate US itself has been caught unaware in a series of accounting scandals in the recent past.

The most controversial issue in the wake of the East Asian crisis has been the role of the IMF in resolution of the crisis. As many as four papers of the volume under review are devoted to a critical assessment of the IMF sponsored programmes in Indonesia, Korea, Thailand and Malaysia. Mari Pangestu and Hadi Soesastro in their paper on Indonesia held the IMF and/or the Indonesian government responsible for the banking panic and closures in the absence of preventive steps such as temporary full deposit insurance. In their opinion, the IMF underestimated the risks and effects of structural reforms on vested interests around the President Suharto. The resultant ambivalence and mixed signals brought the confidence to its nadir. In the case of Thailand, Chalongphob Sussangkarn noted, the IMF prescription of swift upgradation of the prudential standards intensified the vicious cycle of recession, non-performing loan, liquidity crunch and further recession. The full guarantee extended to depositors and creditors as part of confidence-building measures, however, absolved the foreign creditors of much of the attendant risk. On the whole, Thai experience underlines the need for some global norm on management of short-term capital flows. In the context of Malaysia, Mohd. Haflah Piei felt that the IMF conditionalities, which demand structural reforms including further capital account liberalisation at the height of a financial crisis, were largely inappropriate. Indeed, the Malaysian recovery came with loosening of the IMF sponsored fiscal and monetary austerity coupled with imposition of capital controls.

On the other hand, the Korean experience of crisis management turned out to be relatively smooth with establishment of the legal institutions spearheading reforms in banks, corporate sector and labour market. However, the real dilemma, Chungsoo Kim observed in his paper, lies in actual implementation and practices particularly when the extent of government intervention has considerably increased in the economy in course of crisis management. While presenting the IMF's views, Donald Donovan clarified the rationale for structural reforms since the crisis was routed largely in structural factors. The fiscal and monetary programmes were often reviewed, leading to their subsequent easing. Donovan, however, accepted that bank closures in Indonesia could have been thought out more carefully. On the whole, as per Donovan, the single most important lesson of the East Asian crisis is that participants in the global capital

market need to be properly forewarned. While the limitations of the IMF's routine reliance on conventional wisdom in tackling the East Asian crisis were too obvious particularly for countries known for fiscal rectitude, the challenge lies in devising alternative crisis management formulation. Here, however, the picture is not all that unequivocal when pursuit of divergent crisis management policies has produced broadly uniform results – resurgence of the East Asian countries. The turnaround of Malaysia definitely goes against those, who argued that the imposition of capital controls would result in unmitigated disaster. On the other hand, the resurgence of Korea and Thailand does not lend support to those who advocated that the tight monetary and fiscal policies accompanying the currency float would do long-term damage to these countries. In the absence of a consensus, the real world policy making, unfortunately, continues to be a *terrain incognito* dogged by confusion and dilemma.

As part of the regional policy options for the East Asia, Masayuki Kichikawa chalked out an agenda for action during the transition to growth and stability. Regulation of short-term capital flow was advocated particularly in times of financial instability. Besides, partial linkage of the Asian currencies to Yen was prescribed to contain the adverse implications of large swings in Yen-dollar rate as the Asian countries in general imported parts and capital goods from Japan and exported final goods to the US. In his comments, Augustine Tan recommended for developing a long-term bond market to reduce dependence on short-term capital inflow. Similarly, Manuel Montes traced the origin of the crisis to abundance of international liquidity that swamped the domestic financial systems and created dilemmas for exchange rate management. As part of regional co-operation, joint exchange rate management, regional fund for emergency liquidity, and internationalisation of Yen and Singapore dollar were suggested. Indeed, the case for concerted action in the area of fiscal, monetary and exchange rate policies can hardly be emphasised for the East Asian countries having strong financial and trade linkages. Not surprisingly, the initial attempts to stabilise the currency market by pushing interest rate high coupled with fiscal tightening acted as a dampener in an otherwise closely inter-twined region.

In the concluding paper, Antonio Borges focused on the G-3 exchange rates and international monetary system coupled with

their implications for the East Asia. In the context of the mounting US trade and current account deficits, Borges visualised a weakening US dollar and volatile G-3 exchange rates between US dollar, Yen and Euro. He felt that like the European Union, Asia would not be bereft of currency volatility and speculative attack since it was hardly an optimum single currency area. In their comments, Khor Hoe Ee and Edward Robinson observed that the appreciation of Yen during 1986-95 worked as a positive external shock for the Asian economies with FDI flows from Japan. The shift in Japanese production base led to an economic boom in the region.

While the volume has flagged out a number of issues for resolution, it has hardly thrown light on the needed future global financial architecture or issues pertaining to central bank maintenance of foreign exchange reserves. Both these issues have generated lots of interest and assumed considerable importance in recent public policy debates. While the need for an international lender of last resort has long been felt, among others, by Lord Keynes, to tide over a temporary liquidity crisis or its snowballing into a systemic crisis, the possibility of such an establishment appears to be remote in the foreseeable future. Meanwhile resources at the disposal of the existing institutions like the IMF need to be enhanced in order to reduce their dependence on the major sponsors (G7 countries) in times of crisis. The potency of foreign exchange reserves in defending a country's currency has been demonstrated by the contrasting experiences of China, Hong Kong and Taiwan, on the one hand and that of the crisis afflicted East Asian countries, on the other. It is in this context, India's record accumulation of foreign exchange reserves to the tune of over US $ 78 billion signals a creditable cushion against external shocks. The crisis has once again highlighted the virtues of transparency and reliability of information disseminated by economic agents including the central bank. Such shortcomings notwithstanding, the volume has turned out to be an important contribution to the understanding of origin and ramifications of the currency crises.

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Book Reviews

India's Fiscal Matters by Parthasarathi Shome, Oxford University Press, New Delhi, 2002, pages 260, Price Rs. 495

The fiscal situation across a wide spectrum of countries poses formidable challenges in public policy making. The way the author has handled these challenges marks his wide experience in this area. The author relies on his analysis of cross-country experience to identify the issues and address them in the Indian context. The book highlights that the prevailing issues and emerging challenges for the fiscal policy in India demand a medium-term fiscal strategy. An efficient and implementable system of taxes, a rational and affordable level of expenditure, role of public and private sectors in economic activities, and an appropriate level of decentralisation should be the essential elements of the medium-term fiscal strategy. The appropriate fiscal strategy would help to move an economy like India towards a higher growth path without high inflation or inter-generational transfers of the burden of public debt.

The book under review attempts to provide inputs in developing a comprehensive medium-term fiscal strategy for India. With the objective of charting out the strategy, it reviews the fiscal performance of the Indian economy during the 1990s when liberalisation of the economy essentially began. While some initial improvement in fiscal health, particularly for the Centre took place, size of the gross fiscal deficit especially from 1997-98 has become difficult to contain both at the Centre as well as State level. The significant growth in expenditure was not matched by similar growth in revenues. Revenue expenditure like interest payments, pensions, wages and salaries triggered the growth in expenditure. On the other hand, capital expenditure registered a marked decline, having adverse implications for the growth process of the economy. Overall, worsening of the combined fiscal position of Centre and State Governments has resulted in voluminous debt and debt service obligations.

The book tries to ascertain the optimal degree of fiscal decentralisation for India in the light of international experience. The theoretical developments on fiscal decentralisation underline its usefulness in optimal utilisation of resources through enhanced local participation in decision making. However, the opposing views point towards lack of efficiency and equity whereby decentralisation could lead to problems in macro-economic management. Issues like corruption and fiscal transparency and their association with fiscal decentralisation are also discussed at length. The international experiences, particularly of Argentina and Brazil reveal that broad based revenue productive taxes such as income and consumption taxes are usually subject to revenue sharing. As revenue share from shared taxes has tended to increase for lower level of governments, federal governments have devised non-sharable taxes that are often inefficient such as tax on financial transactions that appears to have become increasingly popular in Latin America. Besides, there has been hardly any specific rule on distribution of tax revenue, and changes have usually favoured lower level government shares mainly in support of further decentralisation. While rules have to be clear and simple with a minimum of objectives, experience shows that even that is not sufficient if different tiers of government cannot be persuaded to carry out their responsibility adequately. In this connection, only cooperative not competitive federalism will ultimately achieve the desired results in terms of efficient economic growth, fiscal consolidation and equitable vertical and horizontal distribution.

The book provides a comprehensive historical perspective on Indian fiscal arrangements at the local level from the early 20th century right up to the 73rd and 74th amendments to the Constitution, empowering the local governments. It is felt that there is a need to give more taxing power/tax bases, in view of the want for development of social and economic infrastructure at the lower tiers of governments. Further, these governments should make efforts towards setting their tax structure broad-based and efficient in tax collections with user charges and emphasis on productive expenditure. The empirical tests for India cited in the book conclude that decentralisation of expenditure is supportive of higher growth and lower fiscal deficit. It is indicated that decentralised expenditure

responsibilities can improve growth and fiscal performance so long as resource availability is ensured at lower level of government.

The book assesses various measures initiated for improvement in revenue performance during the 1990s, particularly with reference to the Central taxes: reduction in individual and corporate income tax rate, scaling back of custom duties, and rationalisation of excise tax structure. The focus of the on-going tax reform remained on simplification and rationalisation of both direct and indirect taxes. However, the measures have not been accompanied, by and large, by expansions in the tax base. The existing tax incentives in income taxes, exemptions in indirect taxes and omission of a feasible expansion of the tax base through taxation of consumption of services have continued. The various exemptions have also affected the quality of tax administration and revenue performance. For a couple of decades, services sector has grown rapidly and now represent more than half of the GDP. In view of its increasing role in GDP, the taxation of service sector assumes importance. It is imperative to introduce comprehensive taxation of services at the Central level and the selected services should also be seriously considered for appropriate assignment for taxation to the States and local bodies. On taxation of services, India can draw important lessons from Brazil, which was one of the first country to introduce a comprehensive Value added tax (VAT) on both goods and services in the mid-1960s.

In order to enhance the revenue performance, tax reforms have also assumed importance at State level. States have made various efforts to enhance their revenues over the last decade. The taxation policy of many States has been gradually rationalised to make the tax structure simpler, transparent and easy for compliance, and to render support to both trade and industry. It was recognised that competitive sales tax reductions by States aimed at attracting investments had led to revenue losses without commensurate gains. It is in this context, the book has discussed at length the applicability of VAT in India. The VAT has become popular across the world. More than 100 countries have introduced VAT though most of them have introduced at the level of Central government as has been the case with India. The introduction of VAT at the Central

level is not as much challenging as at the State level. Brazil and Canada have introduced VAT even at the State level, while Argentina and India are in the process of doing the same. In India, preparations for a State level VAT have been going on since the early 1990s. Some States have already made efforts to introduce VAT, covering a few items. Recently, with a view to harmonising the inter-state taxes and ultimately switching over to State level VAT, States have introduced uniform floor rates for different groups of taxable commodities during 2000. Currently, preparations are underway for introduction of VAT at the State level as envisaged in the Union Budget, 2003-04. Once introduced, it is expected to increase revenue buoyancy, as the coverage expands to value addition at all stages of production and distribution chain. The issues and challenges ahead in introducing the VAT also assume importance. First, given the floor rates agreed to by the States, it would be difficult to design a VAT that is single rated or even double rated, by any particular State. Thus, there is a need to come to an agreement regarding new floor rates in case any particular State introduces a VAT before others. Secondly, when States introduce a comprehensive VAT, the treatment of inter-state trade under such a VAT has to be resolved and revenue compensation to losing States needs to be considered.

Overall, in view of the sluggish growth in revenue, a broad tax base needs to be developed. Having a broad tax base enables lower average tax rate for generating the same tax revenue. Emphasis should be given to minimise the exemptions from the VAT, deductions from the individual income tax and other incentives given to boost some economic activities like exports. Further, there is a need to maintain a close link between tax policy formulation and tax administration practices. The strategies focusing on rationalisation of tax rates, better tax compliance, improved efficiency in tax administration and review of tax exemptions/incentives would be helpful in improving the revenue performance.

The book has emphasized the importance of fiscal transparency and suggested that proper economic management should be based on a clear fiscal framework, which needs to be developed. In the case of India, though the Five Year Plans do provide a broad

framework for conduct of fiscal policy, the medium-term macro-economic forecasts are rarely used for fiscal policy planning and budgeting. Countries such as Argentina and Brazil have drawn up guidelines for fiscal responsibility in line with the IMF guidelines.

It may be concluded that the book is very timely and pertinent to Indian fiscal affairs. The issues of tax administration, expansion of tax base through more services in tax net, introduction of transparency in fiscal matters and channelisation of expenditure along productive lines are well recognised. Several measures have already been initiated in India during 1990s covering most of these areas. Further, the book provides very useful insights on the optimal level of fiscal decentralisation for India. The discussion on VAT is very relevant and will provide valuable inputs to the policy makers in India to facilitate the smooth implementation of VAT at State level. However, issues like rigidities in bringing expenditure to a lower level or in channelising it towards productive lines apart from sustainability of public debt, which continue to pose problems for the on-going process of fiscal consolidation could have been addressed adequately. Nevertheless, the book remains an important contribution to India's fiscal matters.

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Book Reviews

Money and Monetary Regimes: Struggle for Monetary Supremacy by George Macesich, Pracger Publishers, CT, U.S.A 2002, pp XIV +167,US $ 62.

The title of the book evokes considerable academic curiosity and even excitement in the mind of an aspiring reader, especially if he takes the "Struggle for Monetary Supremacy" at face value. "Struggle for Monetary Supremacy" is generally perceived as a contest among various national currencies for a pre-eminent role in international transactions. However, the present book confines itself to the role of money and the performance of monetary regimes within a national economy.

Ever since the abolition of private banks to issue notes, power and authority in monetary matters are shared between the Finance Ministry and the Central bank. The interlinkage between political power structures and policy introduces an element of discretion in monetary policy. The exercise of such a discretion, according to the author, affects the conduct of monetary policy. The efficacy of monetary policy can be substantially enhanced through imposition of constraints on the use of discretionary authority in monetary affairs by bureaucracy and political elites. The author provides interesting historical accounts of the rules versus discretion debate by looking at the actions of the Federal Government in USA to deprive the Second Bank of United States (a defacto Quasi Central bank at that time) of its right to hold Federal deposits and of its Federal Charter during 1830s. Two instances of an international perspective are presented in detail. These relate to imposition of 'indemnity payment' by Germany on France after Franco-German war of 1871, and imposition of 'reparation payment' by the allies on Germany after the end of the First World War.

The author exhibits a lurking predilection for the gold standard monetary regime at the global level, scarcely falling short of overt espousal of its return. This emerges both from his uncharitable

treatment of the 'fiat monetary regime' through much of the book, and from his categorical attribution of virtues of relative stability to gold standard era with respect to both real growth in gross national product (GNP) and absolute price level. The statistical figures that he adduces to support his contention of greater stability in real GNP growth are far from sufficient to conclusively vindicate that contention (besides being confined to only two countries, the U.K. and the USA). More importantly, the author overlooks the fact that long-run GNP growth rate has been faster in most countries, including the U.K. and the USA, under the fiat monetary regime, than under the earlier gold standard regime - a higher rate of secular growth would make greater degree of sub-period deviations more inevitable as well as more acceptable. Even the protracted economic travails and tribulations of the inter-war period as a direct result of growing shortage of gold at the global level are unconvincingly dismissed by the author as being due to "unfortunate coincidence".

The argument presented in the book strongly supports the view that much greater discipline at the policy level, and much greater order at the operational level prevailed under the gold standard monetary regime, and disparages the fiat monetary regime in comparison therewith, at various points in the book. The collapse of the gold standard, the onset of the Great Depression of 1930s and the advent of Keynesianism have been discussed by looking at the Keynesian economic model. According to the author, the Keynesian Policy prescriptions introduced elements of discretion in monetary policy and the exponential growth of the bureaucratic set-up in modern democracies. The treatment of Keynes is inadequate, and based on a supply side view of Keynes' Liquidity Preference Theory : "The monetary crises (of the 1930s) was indeed due to an inadequacy in the supply of base money, consisting of gold, …….. This is certainly consistent with what keynes was to call a rise in liquidity preference. In effect, there was not enough base money for the banking system to be able to come to the reserve" (P 50). Thus the author ignores the behaviourial assumptions embedded in Keynesian economics, that, liquidity preference is essentially a psychological phenomenon, which is subject to temporal fluctuation in the face of changing subjective views about future interest rate,

and at its extreme, renders inadequate a money supply which would be otherwise adequate - even substantial increase in money supply at the initiative of the monetary authority gets absorbed by hordes of economic agents, whose preference for cash *vis-à-vis* any other asset becomes absolute.

The discussions on determination of price level in a Keynesian framework is clearly inadequate. The author argues that in the Keynesian model, the absolute price level is determined entirely outside the mechanics of the economic system, with the result, changes in aggregate demand register themselves entirely in output change, and not at all in price level (P 92, also P 62). While it is true that Keynes did highlight certain degree of downward rigidity in the price level, deriving from corresponding rigidity in money wages due to trade union resistance, he saw no such rigidity in the upward movement of the price level. For, while it is integral to the Keynes analytical model that during the upswing of an economy from under employment equilibrium (one of the salient features of the model), every monetary increase does not lead to corresponding increase in commodity prices, the absolute price level is far from unaffected by conditions and movements of the relevant macro economic variables. Indeed, chapter 21 (entitled “The Theory of Price Level”) of The General Theory, which is devoted to a rigorous treatment of the price behavior in the course of an economy’s approach to full employment, delineates intermittent bouts of inflationary pressures (due particularly to shortage of specific inputs and diminishing returns) at what are known as “semi-critical points” before full employment is finally reached. And what is more, after attaining the level of full-employment, at which point true inflation is supposed to set in, every increase in the quantity of money is expressly shown to be accompanied by corresponding increase in the general price level.

The salient theme of the book is the debate over discretion versus rules in the formulation and conduct of monetary policy. The author consistently evinces unconcealed penchant and support for rule-based monetary policy, as against a discretionary one. The present popularity of rule-based monetary regimes is linked to the failure of discretionary monetray regimes to abate inflationary pressures

of 1960s and 1970s in large number of countries. He portrays a regime of discretionary monetary policy as not only inherently expansionary in its stance, but also inexorably inflationary in its outcome. However, a reader well familiar with monetary and banking history would be quick to point out that even during pre-Keynesian era, monetary authority did resort to discretion in ample measure for monetary management, whenever economic exigencies so warranted. The author himself reports instances of monetary expansion in the pre-Keynesian periods in overt disregard of clearly laid down rules for monetary policy. Efforts by monetary authorities in several countries of the world to economise on the gold coinage during gold standard in order to increase the ratio of money stock to the existing gold stock (to which the author makes specific reference on Page 7) is an eloquent testimony to the fact that monetary authorities faced an inevitable need for discretion even in the pre-Keynesian era. One of the main grounds on which the author is distrustful of discretion in monetary policy is the near impossibility of making correct choices, while implementing such a policy. The rule-oriented monetary policy that he has in mind throughout the book is what Milton Friedman advocates in terms of a pre-determined stable annual rate of growth in money supply. Even if the particular rate of growth which is statutorily laid down, happens to be correct and appropriate at the time when such a growth rate is scientifically decided upon, how can that rate be similarly correct and appropriate for all subsequent periods in the face of changes in economic conjunctures and configurations?

With regard to money and monetary policy, the author displays excessive and even exclusive focus on the price level effects (real or putative), and altogether disregards effects on the real sector. He approvingly cites the 19th century dominant view, which was against using monetary expansion even for raising the level of aggregate output and employment. This standpoint, aside from its intrinsic plausibility on empirical plane appears irreconcilable with his dismissal of the very possibility of monetary authority influencing real values of economic variables, including output and employment, and categorically affirms that the impact of monetary changes is confined only to nominal values of these variables. Moreover, the author grants a dubious role for monetary policy, when he speaks

of monetary disorder adversely affecting real magnitudes; that is to say, in positive direction, money affects only nominal values, but in negative direction, it affects real values - a standpoint that has everything in it to severely circumscribe the perceived role of monetary policy, and to engender diffidence in the minds of monetary authorities. He generally endorses policy prescription of economist like Milton Friedman for a statutorily fixed rate of annual growth in money supply as a sure means of reducing fluctuation in prices, real output and employment. However, readers with more realistic view of economic variables and tendencies cannot help questioning the practical value of such a policy-prescription, in so far as fluctuation in the real sector like effective demand, technology, labour efficiency/ attitude, and even weather (which has a crucial bearing on agricultural output) would inevitably tend to entail fluctuation in prices, output and employment, especially in prices - it is disparity between money and real output that causes price fluctuation.

The book has an intellectually stimulating chapter on fiscal policy dealing with some new concepts. First is the concept of 'Fiscal Policy Multiplier', which denotes ratio of change in real Gross National Product to policy induced fiscal changes. The second is the concept of 'Formula Flexibility', which denotes counter-cyclical fiscal measures through legislative changes in tax rates/ exemptions, in contrast with 'built-in flexibility', by which counter-cyclical fiscal changes are brought about automatically by the very cyclical movements in the economy. The chapter advocates legislatively stipulated balanced budget, which has its counterpart in the idea of 'Fiscal Responsibility Act' in this country. In the United States, as early as 1982, under the Republican Administration of President Reagan (known for strong conservative persuasions on monetary and fiscal matters) a proposed constitutional amendment for a legislatively mandated balanced budget was rejected by the Congress. What this implies is that it is easy for people to speak or write glibly about balanced budget, fiscal responsibility, but those in the helm of fiscal affairs become conscious of the stark fact that such a limitation on the executive may create more problems than it solves in terms of day-to-day economic management. In fact the author himself alludes to the attempts in the United States to cut federal spending in the 1980s, under the relentless campaign of

the advocates of constitutionally mandated fiscal balance. Yet these attempts only led to further increase in the federal deficits because of the deep recession that ensued in consequence of such cuts in spending - recession meant decline in fiscal receipts due to lower aggregate income, and rise in expenditures due in particular to income transfers to the unemployed.

The book has a chapter on 'Inflations and Monetary Regime'. The author portrays the post World War II period as particularly inflationary, which he attributes to hyper sensitivity of policy makers to any degree of unemployment. The author also discusses the influence of trade unions and oligopolies on inflationary trends. He holds monetary increase as necessary pre-conditions for the successful exercise of market power by trade unions and oligopolies, a contention, whose empirical validity is conspicuously called in question by stagflationary experiences in different countries at various periods. He also glosses over the distinction between demand-pull and cost-push varieties of inflation on the plea that Keynesians and monetarists, respectively, regard types of inflation as empirically and conceptually indistinguishable.

The chapter on monetary policy brings out the dichotomy between 'adaptive' expectation and 'rational' expectation. Adaptive expectation is based on forecasting movements of economic variables on the basis of their behavior in the recent past - veritable extrapolation, so to say. Rational expectation, on the other hand, takes into account the past behavior of not only the variable being forecast, but also of other variables which interact with that variable, besides any other information under the possession of economic agents about possible future course of economic variables in general. The author makes the economically crucial point that the econometric models based on adaptive expectations (which dominantly influenced model-buildings until mid-1970s) mislead policy makers into regarding inflation as integral to the national economic structure. The operational implication of such models was that monetary and/or fiscal policy, to have any durable dent on the inflationary process, would need to be restrictive for a very long time, since the lower inflation rate would have to pass through the parameters of adaptive expectation process in order to alter the momentum of inflationary course in

a significant manner. Consequently, policy makers were erroneously advised by the users of such models into believing that halting inflation would impose unacceptable costs on society in terms of unemployment and output losses, a belief which, as the author points out, had imparted an inflationary bias to macroeconomic policies in most industrialised countries. At the same time the author is not much sanguine about the alternative models based on the rival 'rational' expectations hypothesis. After underscoring certain possible scenarios, citing Robert Lucas, the author urges economists to reconsider the entire way in which econometric models are formulated.

In retrospect, the book is readable for the engrossing debate among major schools of economic thought : between Monetarists and Keynesians, between those who regard money as the ultimate provenance of price movements, and those who emphasise a host of non-monetary factors in this regard; between those who exaggerate the importance and feasibility of a stable price level, and look upon any inflation as an unmixed evil, and those who accept the inevitability of price instability in the course of economic progress, and even believe in utility of inflation within moderate limits in this regard; and between those who advocate rule-based monetary and fiscal policy as a panacea for problems of economic instability, and those who would like monetary and fiscal authorities to have sufficient latitude to counter instability from non-monetary factors.

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I, Narendra Jadhav hereby declare that the particulars given above are true to the best of my knowledge and belief.

Date: May 27, 2003

(NARENDRA JADHAV)
Signature of the Publisher

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