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# *Short Term Interest Rate and Real Economic Activity*

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This paper examines the impact of short term interest rate on real activity in India using monthly data over the period 1961-2000. Using rolling regression technique, monetary impulses transmitted through interest rate effects are compared with policy changes effected through liquidity effects. The empirical evidence points out that interest rate has emerged as a significant factor for explaining the variation in real activity in the 1990s. The empirical results have important implications for monetary policy, particularly with respect to the interest rate channel of monetary transmission.

## Background

Interest rates have assumed a key role as an instrument of macroeconomic policy. Since the 1970s, driven by McKinnon and Shaw's hypotheses, policy authorities have rolled back repression regimes and have undertaken concerted reform measures in their endeavor to strengthen competition and improve the functioning of financial markets. Deregulation of interest rate is the most common element of financial reforms occurring around the world. Shifts in operating procedures of monetary control have accompanied these changes in the policy environment, paving the way for a shift from direct instruments to indirect instruments of monetary control. Short term interest rates have become the key instrument through which central banks transmit policy impulses to the financial market. The famous Taylor's interest rate rule linking output gap and inflation gap has been employed by various central banks as the basis for setting up a reaction function.

In India, almost all major interest rates have been set free with banks and financial institutions being empowered to determine their own lending rates and deposit rates, except the saving deposit rate which is set by the Reserve Bank of India. In the 1990s, various financial prices have displayed reasonable comovement, reflecting

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the improvement in operating efficiency of the financial market spectrum. The growing flexibility in interest rate behaviour has sparkled off a debate in India on the real effects of interest rates. Concerns have been raised regarding the potential variability imparted to real activity due to interest rate changes occurring in the financial market.

The paper undertakes an exploration of the interest rate effect on real activity in the 1990s as compared with the 1980s. The rest of the paper consists of three parts. Section I contains review of the literature on this subject with a view to seeking an appropriate framework for empirical investigation. Section II analyses the empirical results. Section III summarises the findings of the study and offers some concluding observation.

## Section I

## The Literature in a Capsule

The last two decades have witnessed a surge of empirical studies on money and finance providing evidence of sharp real effects caused by changes in short term interest rates. In particular, studies on the interest rate channel of monetary transmission and the yield curve have demonstrated that effect of short term interest rate movements on real activity can be more pronounced than the effect of changes in financial quantities such as money or credit aggregates.

Stock and Watson (1989), Friedman and Kuttner (1992a, 1992b, 1993), Bernanke and Blinder (1992) and Emery (1996) presented evidence that interest rate and interest spreads outperform the monetary aggregates as predictors of real economic activity. These studies have found that the spread between commercial paper rate and treasury bills is highly significant in explaining output fluctuation. The federal funds rate, in particular, was found to contain significant information for predicting real activity in the US economy. Bernanke (1990) and Stock and Watson (1993) pointed out that predictive power of paper-bill spread weakened during the second half of the 1980s and the early 1990s.

Subsequent empirical approaches to the subject have moved away from pure *atheoretical* to *structural* vector autoregression models. Strongin (1992), Gordon and Leeper (1994) and Bernanke and Mihov (1995) focused on various refined measures of monetary aggregates using explicit models of the reserve market and central bank operating procedures. The merit of the structural VAR studies was that they focus on identifying monetary policy shocks. However, the usefulness of these studies have been questioned in several quarters. Rudebusch (1996), for instance, argued that the empirical results of these econometric studies are fragile and at odds with other evidence on the nature of central bank's reaction function and policy surprises, particularly the Fed in the United States. Thoma and Gray (1998) challenged empirical findings of these studies by pointing out that the empirical evidence on interest rate effect is biased to few sample observations. Using rolling regres-sion technique, they found that financial variables do not predict real activity on a sustained basis.

Theoretically, these empirical studies have derived justification for their findings from neoclassical postulate on the finance literature i.e., a competitive financial market has an edge over regulated financial market in terms of operating efficiency as well as allocation efficiency. In a free financial market, resources are mobilised most efficiently and allocated to productive sectors which bear lower risk and fetch high returns. From policy point of view, changes in short term interest rates alter marginal cost of borrowing for the business sector. In a competitive market, policy induced changes in short term interest rate may percolate down to the entire spectrum of interest rates and therefore, affect the yield curve. Such changes in the yield curve affect business expectation and investment decision which in turn affect real activity[1].

Although, these empirical findings have been offered to justify the progressive weakening of liquidity effect on real activity, the declining liquidity effect has adduced to inappropriate measure of money and credit aggregates (Thoma and Gray,1998). Moreover, it has been argued that waning of liquidity effect suggests money neutrality. Another view point is that the breakdown of money-output relationship stems from the type of stationarity assumption imposed on the data (Hafer and Kutan,1997). Assuming difference stationarity in the data produces results which are in agreement with the studies pointing out the breakdown of money-output relationship. If trend stationarity is imposed on the data generating process, the money and output remain statistically related. Moreover, the change in stationarity assumption greatly affects the quantitative importance of interest rates in explaining output.

**Methodology**

Most empirical studies report the full sample causality tests which may be affected by the episodes of excessive market activity in the sample periods or isolated spikes in the interest rate variable during crises. Evolution of interest rate effect can be justified only if it exists on a sustained and continuity basis over time. In view of this statistical bias, Swanson (1998) and Thoma and Gray (1995, 1998) argued that the rolling regression technique constitutes an appropriate framework for empirical investigation of comparative performance of alternate monetary transmission process. This paper applies rolling regression technique in a single equation as well as multiple equation setting of VAR systems consisting of four major variables, money, output, prices and interest rate. In the single equation framework, the study uses the linear feedback methodology owing to Geweke (1982,1984) for quantifying the importance of interest rate conditional upon price and money variables. Such an exercise provides meaningful information input to the policy making process (McGarvey, 1985, Cushing and McGarvey, 1990).

The framework of the empirical model can be outlined in the following way. For the single equation model, the rolling regression of the output equation takes the form of

$$\Delta Y_{t,T} = c + \alpha_j \sum \Delta Y_{t-j,T} + \beta_j \sum \Delta P_{t-j,T} + \varphi_j \sum \Delta M_{t-j,T} + \omega_j \sum \Delta R_{t-j,T}$$

where $\Delta$ denotes first difference operator, j the common lag length, Y, P, M are natural logarithm of output (index of industrial production), price, broad money and R interest rate, respectively. The equation is rolled over T times by adding one year data to the sample beginning from a starting sample period *i.e.*, 1961 to 1985. For each variable, Granger's causality statistic (F statistic) can be derived for testing whether the lags of explanatory variables are significant in the output equation. In order to estimate the linear feedback from explanatory variables, money and interest rate to output, the Geweke's methodology involves the following set of regression equations.

$$\Delta Y_t = c + \alpha_j \sum_{j=1}^{k} \Delta Y_{t-j} + \varepsilon_{1t} \qquad (1)$$

$$\Delta Y_t = c + \alpha_j \sum_{j=1}^{k} \Delta Y_{t-j} + \omega_j \sum_{j=1}^{k} \Delta R_{t-j} + \varepsilon_{2t} \qquad (2)$$

$$\Delta Y_t = c + \alpha_j \sum_{j=1}^{k} \Delta Y_{t-j} + \beta_j \sum_{j=1}^{k} \Delta P_{t-j} + \varepsilon_{3t} \qquad (3)$$

$$\Delta Y_t = c + \alpha_j \sum_{j=1}^{k} \Delta Y_{t-j} + \beta_j \sum_{j=1}^{k} \Delta P_{t-j} + \omega_j \sum_{j=1}^{k} \Delta R_{t-j} + \varepsilon_{4t} \qquad (4)$$

$$\Delta Y_t = c + \alpha_j \sum_{j=1}^{k} \Delta Y_{t-j} + \beta_j \sum_{j=1}^{k} \Delta P_{t-j} + \varphi_j \sum_{j=1}^{k} \Delta M_{t-j} + \varepsilon_{5t} \qquad (5)$$

$$\Delta Y_t = c + \alpha_j \sum_{j=1}^{k} \Delta Y_{t-j} + \beta_j \sum_{j=1}^{k} \Delta P_{t-j} + \varphi_j \sum_{j=1}^{k} \Delta M_{t-j} + \omega_j \sum_{k}^{k} \Delta R_{t-j} + \varepsilon_{6t} \qquad (6)$$

where j-the lag length ranges from 1 to K[2]. Equation 1 entails that output is explained by its past lags capturing autoregressive secural trend component of output and the unexplained component $\varepsilon_{1t}$. In the equation 2 and 3, interest rate and price variables are introduced separately, and in equation 4 and 5, financial variables money and interest rate, are employed alternatively along with prices as the conditioning variable. Equation 6 includes both money and interest rate at the same time. The errors of these equations are used to estimate linear feedback and conditional feedback from financial variables to output in the following way.

$F_{R\text{-}y} = Ln[var(\varepsilon_{2t})/var(\varepsilon_{1t})]$
$F_{R\text{-}y|P} = Ln[var(\varepsilon_{4t})/var(\varepsilon_{3t})]$
$F_{R\text{-}y|P,M} = Ln[var(\varepsilon_{6t})/var(\varepsilon_{5t})]$

where Ln denote natural logarithm and var($\varepsilon_t$) indicate variance of error terms, $F_{R\text{-}y}$ indicates unconditional bivariate linear feedback from interest rate to output. The $F_{R\text{-}y|P}$ indicate the conditional linear feedback from interest rate to output, conditional upon price. The measure $F_{R\text{-}y|PM}$ indicates the conditional feedback from interest rate to output, conditional upon the presence of price and money at the same time. In a similar manner, feedback from money and output can be derived. Also, the contemporaneous feedback from interest rate and money to output can be estimated by introducing current lags of these variables in the output equation. For instance, the bivariate unconditional contemporaneous linear feedback ($F_{Ry}$) from interest rate to output can be derived as

$F_{Ry} = Ln[var(\varepsilon_{7t})/var(\varepsilon_{2t})]$

where the error term $\varepsilon_{7t}$ is derived from the equation

$$\Delta Y_t = c + \alpha_j \sum \Delta Y_{t-j} + \omega_j \sum \Delta R_{t-j} + \varepsilon_{7t}, \qquad \text{for } j = 0, ..,K.$$

In the same manner, the feedback from output to interest rate can be derived and the overall feedback ($F_{R\Theta y}$) between interest rate and output will be arrived as the sum of three effects:

$$F_{R\Theta y} = F_{R\text{-}y} + F_{y\text{-}R} + F_{Ry}$$

These feedback estimates can be estimated by rolling over the sample size to include additional information for a year from the chosen base year. As a result, linear feedback can be compared on annual basis. A simple transformation of each feedback measure, 1 - exp(-F), gives the reduction in the one step ahead univariate linear prediction error variance of Y. For example, 1 - exp($-F_{R\text{-}Y}$) is the proportion of the variance in Y given past Y, explained by R.

## Section II

## Empirical Results

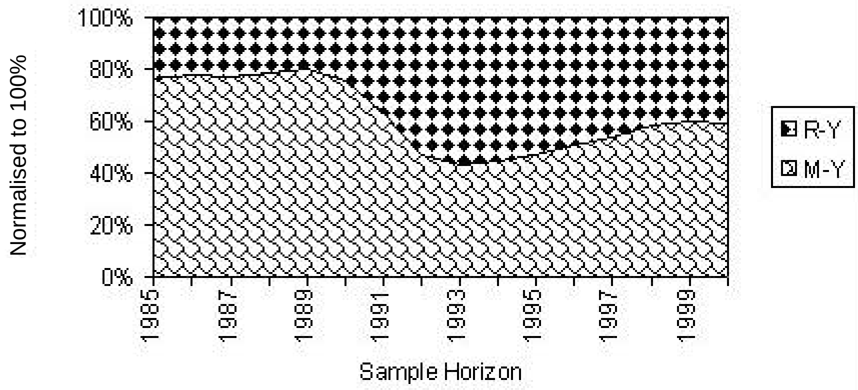
First, it is necessary to explain the choice of the relevant short term interest rate. The interbank call money rate is chosen as the indicator of short term rates. There are several reasons for choosing this variable. First, it is the only interest rate variable determined by market forces before the 1990s and data are available on historical basis. Secondly, the underlying risk factor is comparable with reference to a benchmark gilt rate. Thirdly, recent studies on financial integration suggest that treasury bills rate and call money rate are highly correlated, changes in monetary policy has immediate effect on these segments of the financial market. Fourth, in the money market, banks constitute major players in the market. Change in the call money rate will adequately reflect underlying changes in the marginal cost of borrowing from the banking sector, the leading source of short term finance to business. The sample covers the period from 1961, April to 2000, March. The purpose of using a long sample size was to contain the upward bias in estimates owing to few spikes in interest rates.

### Granger's Causality Test

Table 1 reports the computed 'F' statistic for the null hypothesis that interest rate and money do not Granger cause output. The computed F statistic turns insignificant for the late 1980s, ruling out causal link between interest rate and output. The causal link become significant as the computed F statistic turns out much stronger for most part of the 1990s, particularly the first half than in the late 1980s, the period preceding financial reforms. Thus, the null hypothesis of no causality running from interest rate to output can be rejected for the 1990s[3]. The last three years *i.e.*, 1998-2000, have seen the weakening of interest rate effect. But in the case of money, the causality statistic remains significant for all the years, implying that liquidity variable continues to be a statistically significant factor for explaining variation in real output.

As reported earlier, the F statistic only indicates the direction of causality impact but not the magnitude of causal influence of explanatory variables on the dependent variable. For this purpose, the estimate of Geweke's linear feedback sheds important insights[4]. Table 2 reports the linear feedback from interest rate and money to output. From this table, the feedback estimates provide a picture similar to the one given by causality statistic. During the late 1980s, linear feedback from interest rate to output was barely 2 per cent, whereas the money effect was about 8 per cent, 4 times larger than interest rate effect. The interest rate effect overtook the money effect during 1992-96 and declined towards the late 1990s. On the other hand, the liquidity effect has shrunk consistently. In relative terms, the interest effect is as important as the money effect during the 1992-96, and coming down to a competitive level as compared with the size of the money effect during the late 1990s. Thus, from the late 1980s to the late 1990s, there has been a remarkable change in the comparative effect of money and interest rate on real activity. The comparative performance of these two effects are shown in Chart I.

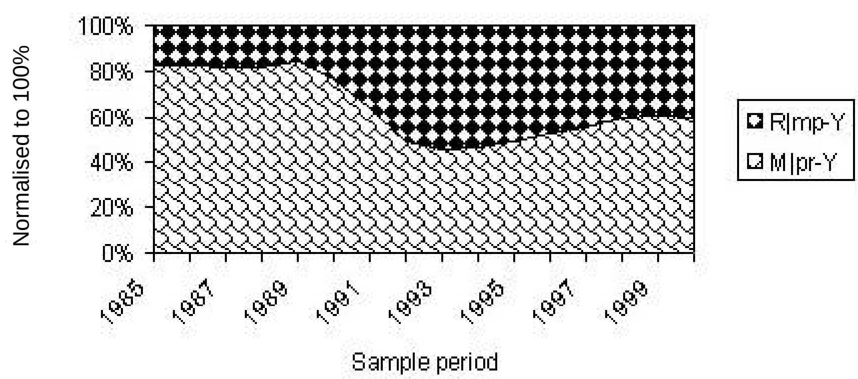
**Chart 1 (a) : Relative Impact of Money(M) and Interest Rate(R) on Output Unconditional Linear Feedback**



There is another interesting observation from the empirical linear feedback estimate. The joint impact of money and interest rate on output works out at 10-11 per cent for the late 1980s. The joint feedback went up to about 15-16 per cent during the first half of the 1990s and it receded to about 10 per cent during the late 1990s which is more or less the same with the estimates for the late 1980s. The broad pattern of empirical evidence needs to be carefully interpreted.

One possibility is that there exists a threshold limit (a natural response) to which real sector responds to financial innovations. During the process of financial reforms, it is possible for the real sector to react to financial innovations above its natural response path but the same trend may not continue for all the time. On the other hand, the real sector was going through a set of structural problems owing mainly to sluggish domestic demand condition besides the Asian Crisis at the international front during the 1998-99. There was some perception that the real interest rate was upwardly sticky as the inflation rate was at its lower end and the real sector was expecting some policy induced changes in nominal interest rate structure. In view of this, the response of real activity to nominal interest rate changes may have somewhat declined.

**Chart 1 (b) : Relative Impact of Money and Interest Rate on Output Conditional Linear Feedback**



**Results from Vector Autoregression Model**

The single equation may obscure the relationship among economic variables when they could be simultaneous interactions. Another problem with the single equation is that out of sample prediction error can not be comparable on annual basis. On the other hand, forecast error variance decomposition in vector autoregression (VAR) model can be comparable for different forecast horizons. In this regard, it is relevant to compare the broad pattern of results with the results of the multivariate VAR model in which all the variables are treated as endogenous in nature. The VAR model consisting of four variables money, output, prices and short term interest rate were run in a rolling regression setting by changing the sample horizon by 12 months with the base period 1961-85. All the variables were first differenced in order to bypass the non-stationarity problem and the system included seasonal dummies and a constant term as deterministic components. In order to examine how important these variables are for explaining output variation, the forecast error variance decomposition of industrial production was examined. Since orthogonalised forecast error decomposition is likely to be affected by ordering of variables, generalised forecast error variance method is used which is free from ordering effect. Table 3 provides the summary of output variation being explained by the variables in the system for different horizons and sample periods.

The results provide interesting insights. Beginning with the sample period 1961-85, short run monetary effects accounted for about 7 per cent of the variation in output over a 12 month horizon. Over a 24 month horizon, its effect hardly improves by 1 per cent. Over long horizon of about 120 months or 10 years, this effect does not increase, implying that short term variation in money can not produce persistent effects on real output. With respect to the interest rate effect, it accounted for about 2-3 per cent of output variation during the same period and forecast horizon.

As the sample size increased, the money and interest effect did not record any remarkable change on a comparative basis until 1989. But their comparative performance went through a remarkable change during the first half of the 1990s. The effect of variation in money on output decreased beginning with the year 1990 whereas the interest rate effect increased. The interest rate effect overtook the money effect from 1991, with its effect on output going up to about 10 per cent as compared with the money effect of 6-7 per cent. The dominance of interest rate over money continued till 1998. Thereafter, the interest rate effect and money effect differ by 1 per centage point for the years 1999 and 2000. The results are similar to the estimate of linear feedback reported in the earlier section. The empirical results are consistent with the process of financial liberalisation in India.

## Section III

## Summary of Findings

(i) The interest rate has emerged as a statistically significant factor in explaining variation in real activity in the 1990s as compared with its negligible impact in the 1980s, it has become stronger in the 1990s, the phase of reforms period. The liquidity effect continues to be a significant factor but in terms of magnitude it has diminished.

(ii) The empirical evidence supports the continuity in interest rate effect through out the 1990s. In a situation of incomplete integration and less than perfect competitions, economic agents consider interest rate among other variables in allocational decisions and for measuring the risk and return characteristics of financial products. In this regard, quantity of money and its flows will definitely continue its impact on agents' economic choices.

(iii) The gradual decline in liquidity effect has no implications for credibility of monetary policy. In a maturing economy, economic agents attach less importance to nominal aggregates as compared to real factors in investment decisions. The changes in nominal aggregate will have only temporary effects. Interest rate effects underscore the linkage between financial sector and real activity and therefore, enhance policy credibility in a competitive market. The continuity in the statistical significance of interest rate effect on real activity in the 1990s has important implications for monetary policy, particularly with respect to interest rate channel of monetary transmission.

## Notes

1. For a review of this subject, see 'Yield Curve and Real Activity' a Box item in R.B.I. Annual Report, 1998.

2. Various lag selection criteria did not yield in uniform lag structure. However, empirical experiment with various lags (upto 12 months) did not have any effect on the nature of empirical findings. We chose six lags as results were more meaningful as compared with higher order lags. Moreover, the choice of six lags appears plausible from the viewpoint of the frequency of monetary and credit policy.

3. The computed F statistic changed marginally but remained significant when few sample outliers (i.e., changes in interest rate being more than 9 per cent) were trimmed from call money rate.

4. The contemporaneous feedback between interest rate and money and output was negligible within a range of 0.5 to 1per cent. The reverse feedback from output to money was stable where as the feedback to interest rate followed the same direction of the feedback from interest to output (as shown in the Table 2, last two columns). Therefore, there was no change discernible in the broad pattern of overall feedback from money and interest rate to output and only, linear feedback is analysed.

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**Table 1 : Granger's Causality Test : Computed F statistic**

| Sample | Bivariate | | Conditional Upon Price or Money | | | Conditional Upon Both Price and Money | |
|---|---|---|---|---|---|---|---|
| Years | R-Y | M-Y | R\|p-Y | R\|m-Y | M\|p-Y | R\|pm_Y | M\|pr-Y |
| 1985 | 1.09* | 3.73 | 1.00* | 0.95 | 4.36 | 0.83* | 4.09 |
| 1986 | 1.07* | 4.02 | 1.04* | 0.90* | 4.69 | 0.84* | 4.41 |
| 1987 | 1.16* | 4.19 | 1.14* | 1.00* | 4.88 | 0.97* | 4.63 |
| 1988 | 1.16* | 4.49 | 1.16* | 1.02* | 5.16 | 1.02* | 4.93 |
| 1989 | 1.13* | 4.94 | 1.11* | 0.95* | 5.62 | 0.93* | 5.34 |
| 1990 | 1.55* | 5.12 | 1.57* | 1.61* | 5.72 | 1.65* | 5.73 |
| 1991 | 2.88 | 5.03 | 2.81 | 3.14 | 5.42 | 3.07 | 5.64 |
| 1992 | 6.05 | 5.25 | 5.91 | 6.10 | 5.59 | 5.93 | 5.61 |
| 1993 | 6.53 | 4.78 | 6.33 | 6.73 | 5.13 | 6.48 | 5.30 |
| 1994 | 6.29 | 4.93 | 6.05 | 6.50 | 5.24 | 6.23 | 5.42 |
| 1995 | 5.95 | 5.18 | 5.73 | 6.11 | 5.48 | 5.88 | 5.63 |
| 1996 | 5.03 | 5.17 | 4.91 | 5.15 | 5.47 | 4.99 | 5.55 |
| 1997 | 4.29 | 4.98 | 4.17 | 4.42 | 5.26 | 4.25 | 5.34 |
| 1998 | 3.13 | 4.42 | 3.11 | 3.30 | 4.73 | 3.26 | 4.86 |
| 1999 | 2.95 | 4.51 | 2.98 | 3.09 | 4.81 | 3.09 | 4.90 |
| 2000 | 3.11 | 4.59 | 3.12 | 3.26 | 4.88 | 3.25 | 4.98 |

* these are not significant at 5 per cent level of significance.

**Table 2 : Estimate of Geweke's Linear Feedback From Interest Rate and Money to Output**

| Proportion of Error Variance in Y Explained: 1 - exp(-F) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Bivariate | | Conditional (P) | | | | Joint Feedback | | Reverse Feedback | |
| Year | M-Y | R-Y | R\|p-Y | R\|m-Y | M\|pr-Y | R\|mp-Y | MR-Y | MR\|p-Y | Y\|rp-M | Y\|mp-R |
| 1985 | 0.078 | 0.024 | 0.023 | 0.022 | 0.089 | 0.019 | 0.098 | 0.110 | 0.028 | 0.008 |
| 1986 | 0.080 | 0.023 | 0.023 | 0.020 | 0.091 | 0.019 | 0.098 | 0.111 | 0.028 | 0.007 |
| 1987 | 0.080 | 0.024 | 0.024 | 0.021 | 0.091 | 0.021 | 0.100 | 0.113 | 0.029 | 0.006 |
| 1988 | 0.082 | 0.023 | 0.023 | 0.020 | 0.093 | 0.021 | 0.101 | 0.114 | 0.027 | 0.007 |
| 1989 | 0.087 | 0.021 | 0.021 | 0.018 | 0.096 | 0.018 | 0.103 | 0.116 | 0.026 | 0.007 |
| 1990 | 0.087 | 0.028 | 0.029 | 0.030 | 0.099 | 0.031 | 0.114 | 0.125 | 0.026 | 0.008 |
| 1991 | 0.082 | 0.049 | 0.049 | 0.054 | 0.095 | 0.054 | 0.132 | 0.139 | 0.029 | 0.013 |
| 1992 | 0.083 | 0.094 | 0.094 | 0.097 | 0.091 | 0.096 | 0.172 | 0.177 | 0.027 | 0.043 |
| 1993 | 0.074 | 0.098 | 0.097 | 0.102 | 0.084 | 0.100 | 0.169 | 0.172 | 0.024 | 0.061 |
| 1994 | 0.074 | 0.092 | 0.090 | 0.096 | 0.083 | 0.094 | 0.163 | 0.166 | 0.023 | 0.051 |
| 1995 | 0.075 | 0.085 | 0.083 | 0.088 | 0.083 | 0.087 | 0.157 | 0.160 | 0.023 | 0.044 |
| 1996 | 0.073 | 0.071 | 0.070 | 0.073 | 0.080 | 0.072 | 0.141 | 0.144 | 0.022 | 0.043 |
| 1997 | 0.068 | 0.059 | 0.059 | 0.062 | 0.075 | 0.061 | 0.126 | 0.129 | 0.024 | 0.030 |
| 1998 | 0.059 | 0.043 | 0.043 | 0.046 | 0.067 | 0.046 | 0.102 | 0.107 | 0.020 | 0.025 |
| 1999 | 0.059 | 0.039 | 0.040 | 0.042 | 0.065 | 0.042 | 0.098 | 0.103 | 0.021 | 0.022 |
| 2000 | 0.058 | 0.040 | 0.041 | 0.043 | 0.065 | 0.043 | 0.099 | 0.1031 | 0.021 | 0.022 |

**Table 3 : Generalised Forecast Error Variance Decomposition of Output**

| Sample (End) March | Forecast Horizon | DLY | DLP | DLM3 | DR |
|---|---|---|---|---|---|
| 1985 | 1 | 0.973 | 0.004 | 0.015 | 0.011 |
| | 6 | 0.893 | 0.013 | 0.072 | 0.024 |
| | 12 | 0.885 | 0.014 | 0.076 | 0.026 |
| | 24 | 0.885 | 0.014 | 0.076 | 0.026 |
| | 120 | 0.885 | 0.014 | 0.076 | 0.026 |
| 1986 | 1 | 0.975 | 0.005 | 0.014 | 0.009 |
| | 6 | 0.891 | 0.014 | 0.074 | 0.022 |
| | 12 | 0.884 | 0.015 | 0.080 | 0.023 |
| | 24 | 0.883 | 0.015 | 0.080 | 0.023 |
| | 120 | 0.883 | 0.015 | 0.080 | 0.023 |
| 1987 | 1 | 0.976 | 0.006 | 0.012 | 0.007 |
| | 6 | 0.888 | 0.013 | 0.077 | 0.020 |
| | 12 | 0.882 | 0.015 | 0.081 | 0.021 |
| | 24 | 0.882 | 0.015 | 0.081 | 0.021 |
| | 120 | 0.882 | 0.015 | 0.081 | 0.021 |
| 1988 | 1 | 0.974 | 0.007 | 0.015 | 0.007 |
| | 6 | 0.886 | 0.014 | 0.079 | 0.021 |
| | 12 | 0.881 | 0.015 | 0.082 | 0.022 |
| | 24 | 0.881 | 0.015 | 0.083 | 0.022 |
| | 120 | 0.881 | 0.015 | 0.083 | 0.022 |
| 1989 | 1 | 0.974 | 0.006 | 0.018 | 0.006 |
| | 6 | 0.879 | 0.013 | 0.092 | 0.017 |
| | 12 | 0.872 | 0.015 | 0.096 | 0.019 |
| | 24 | 0.871 | 0.015 | 0.096 | 0.019 |
| | 120 | 0.871 | 0.015 | 0.096 | 0.019 |
| 1990 | 1 | 0.968 | 0.005 | 0.015 | 0.032 |
| | 6 | 0.861 | 0.012 | 0.079 | 0.062 |
| | 12 | 0.855 | 0.014 | 0.083 | 0.062 |
| | 24 | 0.855 | 0.014 | 0.083 | 0.062 |
| | 120 | 0.855 | 0.014 | 0.083 | 0.062 |

(Contd.)

**Table 3 : Generalised Forecast Error Variance Decomposition of Output (Contd.)**

| Sample (End) March | Forecast Horizon | DLY | DLP | DLM3 | DR |
|---|---|---|---|---|---|
| 1991 | 1 | 0.969 | 0.003 | 0.015 | 0.019 |
| | 6 | 0.837 | 0.008 | 0.070 | 0.088 |
| | 12 | 0.825 | 0.011 | 0.074 | 0.092 |
| | 24 | 0.824 | 0.011 | 0.075 | 0.093 |
| | 120 | 0.824 | 0.011 | 0.075 | 0.093 |
| 1992 | 1 | 0.946 | 0.001 | 0.015 | 0.037 |
| | 6 | 0.826 | 0.006 | 0.070 | 0.095 |
| | 12 | 0.816 | 0.009 | 0.074 | 0.098 |
| | 24 | 0.815 | 0.009 | 0.074 | 0.099 |
| | 120 | 0.815 | 0.009 | 0.074 | 0.099 |
| 1993 | 1 | 0.951 | 0.001 | 0.012 | 0.033 |
| | 6 | 0.827 | 0.005 | 0.061 | 0.101 |
| | 12 | 0.820 | 0.009 | 0.066 | 0.101 |
| | 24 | 0.819 | 0.009 | 0.066 | 0.102 |
| | 120 | 0.819 | 0.009 | 0.066 | 0.102 |
| 1994 | 1 | 0.956 | 0.001 | 0.010 | 0.029 |
| | 6 | 0.836 | 0.006 | 0.058 | 0.095 |
| | 12 | 0.828 | 0.010 | 0.063 | 0.095 |
| | 24 | 0.827 | 0.010 | 0.063 | 0.095 |
| | 120 | 0.827 | 0.010 | 0.063 | 0.095 |
| 1995 | 1 | 0.962 | 0.001 | 0.009 | 0.025 |
| | 6 | 0.841 | 0.007 | 0.060 | 0.089 |
| | 12 | 0.833 | 0.010 | 0.065 | 0.089 |
| | 24 | 0.832 | 0.010 | 0.065 | 0.090 |
| | 120 | 0.832 | 0.010 | 0.065 | 0.090 |

(Contd.)

**Table 3 : Generalised Forecast Error Variance Decomposition of Output (Concld.)**

| Sample (End) March | Forecast Horizon | DLY | DLP | DLM3 | DR |
|---|---|---|---|---|---|
| 1996 | 1 | 0.968 | 0.000 | 0.007 | 0.021 |
| | 6 | 0.850 | 0.007 | 0.057 | 0.081 |
| | 12 | 0.840 | 0.010 | 0.064 | 0.082 |
| | 24 | 0.840 | 0.010 | 0.064 | 0.083 |
| | 120 | 0.840 | 0.010 | 0.064 | 0.083 |
| 1997 | 1 | 0.970 | 0.001 | 0.007 | 0.020 |
| | 6 | 0.876 | 0.004 | 0.053 | 0.063 |
| | 12 | 0.866 | 0.007 | 0.060 | 0.064 |
| | 24 | 0.865 | 0.007 | 0.060 | 0.064 |
| | 120 | 0.865 | 0.007 | 0.060 | 0.064 |
| 1998 | 1 | 0.980 | 0.001 | 0.005 | 0.013 |
| | 6 | 0.891 | 0.005 | 0.044 | 0.058 |
| | 12 | 0.882 | 0.007 | 0.051 | 0.059 |
| | 24 | 0.882 | 0.007 | 0.051 | 0.059 |
| | 120 | 0.882 | 0.007 | 0.051 | 0.059 |
| 1999 | 1 | 0.980 | 0.001 | 0.005 | 0.012 |
| | 6 | 0.906 | 0.005 | 0.045 | 0.043 |
| | 12 | 0.897 | 0.007 | 0.052 | 0.043 |
| | 24 | 0.896 | 0.007 | 0.052 | 0.043 |
| | 120 | 0.896 | 0.007 | 0.052 | 0.043 |
| 2000 | 1 | 0.980 | 0.001 | 0.005 | 0.013 |
| | 6 | 0.906 | 0.005 | 0.044 | 0.043 |
| | 12 | 0.897 | 0.007 | 0.052 | 0.044 |
| | 24 | 0.897 | 0.007 | 0.052 | 0.044 |
| | 120 | 0.897 | 0.007 | 0.052 | 0.044 |