A Note on Differential Asymmetric Effects of Money Supply and Policy Rate Shocks in India

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Abstract

The paper attempts to analyse the asymmetric effects of money supply and policy rate shocks in India using quarterly data from 1996-97Q1 to 2011-12Q4. It finds that both the shocks impact real output growth and inflation in the short-run, but have a differential impact among components of aggregate demand. An unanticipated hike/cut in policy rate has a symmetric impact of reducing/increasing GDP growth arising due to a corresponding symmetric impact on investment growth only. In contrast, an unanticipated increase/decrease in money supply has an asymmetric impact– only an unanticipated increase in money supply increases private consumption growth and GDP growth, while there is no impact on the other components aggregate demand. An unanticipated hike/reduction in policy rate leads to a symmetric decline/rise in inflation. An unanticipated change in money supply leads to higher inflation, but a similar decrease in it has no significant impact on inflation.

JEL Classification: C32, C51, E31, E52

Key Words: Monetary Policy, Asymmetry, Inflation, Policy Rate

Introduction

The transmission of monetary policy signals to real economic activities and inflation has been a contentious macroeconomic issue. The vast literature on the subject has been evolving over time, in which the change in the monetary policy framework and the monetary policy tools has played an important role. Change in policy (interest) rate has been increasingly recognised and used as the main monetary policy tool by an increasing number of central banks due to money supply becoming an endogenous process. Consequently, focus has shifted to examining the transmission of interest rate signals than that of money supply. Further, while much of the earlier analyses have assumed, either implicitly or explicitly, a symmetric effect of positive and negative monetary shock, recent studies have increasingly emphasised and examined their asymmetric effect. Many of them have found that contractionary monetary policy is more effective than expansionary monetary policy [for example, Cover (1993), Morgan (1993), Thoma (1994) and Karras (1996 a and b)].

In India too, monetary policy transmission has been analysed by a number of studies in the recent period (Al-Mashat, 2003; RBI, 2005; Pandit et al, 2006; Singh and Kalirajan, 2008; Aleem, 2010; Bhaumik *et al*, 2010; Patra and Kapur, 2010; Pandit and Vashisht, 2011; Mohanty, 2012; Khundrakpam and Jain, 2012; Kapur and Behera, 2012; and Khundrakpam, 2013). The broad consensus emerging in these efforts is that monetary policy in India works with a lag of about 2-3 three quarters on output and about 3-4 quarters on inflation, with the impact persisting for 8 to 12 quarters. However, first, the underlying assumption in all of them is that of symmetric impact of monetary policy and, therefore, no differentiation is made between positive and negative monetary policy shocks. Second, most of these studies, barring a few (such as RBI, 2005 and Pandit *et al*, 2006), have considered interest rate (with different proxies) as the monetary policy instrument. The increasing consideration of interest rate as the monetary policy instrument is understandable given the fact that monetary targeting framework was abandoned by 1998, and interest rate was made the main signalling monetary policy instrument under the liquidity adjustment facility (LAF) framework since the beginning of the 2000s. It may, however, be argued that given the continued cash intensive nature of the Indian economy, change in money supply, whether intended or not, could have a significant impact on the real economy. In fact, the RBI still provides the indicative projections of monetary aggregates in its monetary policy reviews, perhaps reflecting their continued importance in policy considerations. Third, attempt has not been made to analyse the differential impact of monetary policy tools among components of aggregate demand.[1] In order to fill these gaps, the note attempts to answer the following questions:

[1] Khundrakpam (2012), however, analysed and found that interest rate changes have a differential impact among components of aggregate demand.

i) Are there asymmetric effects of negative and positive monetary policy shocks on output and inflation?
ii) Do the effects of monetary shocks as defined by interest rate changes differ from those defined by changes in money supply?
iii) Are components of aggregate demand viz., private consumption, investment and government consumption differentially impacted by interest rate shocks and money supply shocks?

The rest of the paper is organised as follows. Section II provides a brief review of the literature. The methodology is described in section III. The empirical estimates and their interpretations are contained in section IV. Concluding remarks are offered in the final section.

II. A Brief Review of the Literature

Economic theories have emphasised that monetary policy shocks could have an asymmetric impact on the economy. There are at least two main strands of theories explaining the asymmetric impact of monetary policy. First is the credit-rationing hypothesis wherein agents in credit markets face credit constraints due to information asymmetry. This credit constraint becomes more binding during recessionary phase than expansionary phase of business cycle. Thus, policy actions will be more effective when implemented in recessionary situations, as increase in cost of capital and tighter liquidity conditions will lead to decline in investment demand (Gertler, 1988; Bernanke and Gertler, 1989).

The other theory is founded on asymmetry in price flexibility in terms of downward stickiness. Due to this downward inflexibility of prices, fall in aggregate demand due to a contractionary monetary policy leads to only reduction in real output. In contrast, rise in aggregate demand due to expansionary monetary policy moderates the increase in real output due to accompanying price rise. Thus, a contractionary monetary policy has a stronger impact on real output than an expansionary monetary policy (Tsiddon, 1993; Ball and Mankiw, 1994).

Empirically, several studies have examined the asymmetric impact of monetary policy on output and inflation in different countries. Many of them support the view that contractionary monetary policy is more effective than expansionary monetary policy, which include Cover (1993), Morgan (1993) and Thoma (1994) for the US and Karras (1996 a and b) for the European economies. However, some studies have contested the above findings arguing that asymmetric effects of money supply on real output is largely influenced by inflation regimes (Rhee and Rich, 1995 and Shen, 2000). Some studies even argue that the above hypothesis either does not hold or the opposite in fact holds. Rhee (1995) finds that in Korea there is little empirical support on inflation responding more to positive monetary shocks than negative shocks. In the case of Australia, Bodman (2006) provide the opposite evidence that while unanticipated expansionary monetary policy raises GDP growth rate significantly, unanticipated monetary policy tightening appear to have no effect.

In the case of India, Aye and Gupta (2012) analysing the asymmetric impact of unanticipated money supply shocks find that expansionary money supply shocks have a bigger effect on output than contractionary money supply shocks, but the asymmetric effect last only for few quarters. On the other hand, negative shocks have a much greater and persistent impact on inflation than positive shocks.

III. Methodology

The method adopted is similar to the two step OLS approach as in Cover (1992), Morgan (1993) and Florio (2005). The first step is to identify the negative and positive monetary policy shocks by estimating a function defining monetary policy process. In the second step, the negative and positive monetary policy shocks are included in the estimate of the models for output and inflation process to assess their impact. We consider both interest rate and money supply as alternative monetary policy instruments. The interest rate process is defined as

$$r_t = \alpha_0 + \sum_{i-1}^{n} \alpha 1_i r_{t-i} + \sum_{i-0}^{p} \alpha 2_i \pi_{t-i} + res_t \quad (1)$$

i.e., interest rate (r_t) is a function of its own lags and lags of inflation.

Change in money supply (ΔM_t) is defined as a function its own lags and lags of real output growth 'y_t' as

$$\Delta M_t = \beta_0 + \sum_{i-1}^{n} \beta 1_i \Delta M_{t-i} + \sum_{i-0}^{p} \beta 2_i y_{t-i} + res_q \quad (2)$$

Positive and negative monetary policy shocks as defined in terms of interest rate and money supply shocks are obtained from the respective residuals 'res_t' and res_qin (1) and (2). Positive shock '*pos'* is defined as *max[res, 0]* and negative shocks '*neg'* as *min [res, 0]* from the two residuals in (1) and (2) for interest rate and money supply, respectively.

Output growth is defined as a function of its own lags and the lags of positive and negative monetary policy shocks in (3) (see for example, MacDonald et al, 2011) as

$$y_t = \gamma_0 + \sum_{i-1}^{n} \gamma 1_i y_{t-i} + \sum_{i-0}^{p} \gamma 2_i pos_{t-i} + \sum_{i-0}^{q} \gamma 3_i neg_{t-i} + \epsilon_t \quad (3)$$

The sum of the coefficients of positive and negative shocks viz., $\sum_{i-0}^{p} \gamma 2_i$ and $\sum_{i-0}^{q} \gamma 3_i$, represents the impact of negative and positive monetary shocks, respectively. The asymmetry in the impact of these two shocks is confirmed from the statistical (Wald) tests that the sums (in value) are different from each other. The exercises were conducted for both interest rate shocks and money supply shocks separately.

To analyse the similar impact on components of aggregate demand, 'y_t' in (3) was replaced by the various components of aggregate demand.

A similar exercise was carried out for inflation by defining the inflation process as in (4) in which inflation ' π_t ' is a function of its own lags, lags of output gap '$OGAP_t$' and lags of positive and negative monetary shocks defined as

$$\pi_t = \delta_0 + \sum_{i-1}^{n} \delta 1_i \pi_{t-i} + \sum_{i-0}^{p} \delta 2_i pos_{t-i} + \sum_{i-0}^{q} \delta 3_i neg_{t-i} + \sum_{i=1}^{s} \delta 4_i \, OGAP_{t-i} + \epsilon_t \qquad (4)$$

IV. Empirical Estimates

For the estimation, quarterly data for the period 1996-97Q1 to 2011-12Q4 were taken from Real Time Handbook of Statistics on Indian Economy (RBI). Weighted average call rate was used as proxy for policy interest rate, while money supply was measured by M_1.[2]

In both the interest rate and money supply process, only one lag of the relevant variables was found to be significant (Table 1). Four lags of positive and negative monetary policy shocks were considered in view of data being of quarterly frequency and also to conserve degrees of freedom. For money supply shocks, the contemporaneous impact was included being significant, while for interest rate shocks it was excluded. The major findings are as in the following.

Table 1: Interest Rate and Money Supply Process

Variables	Call	M_1
(1)	(2)	(3)
Constant	2.33*	0.013*
	(2.88)	(2.83)
$Call_{(-1)}$	0.57*	
	(5.36)	
$\pi_{(-1)}$	38.2	
	(1.75)**	
$\Delta M_{1(-1)}$		0.25*
		(2.27)
$\sum_{i=0}^{1} y_{t-i}$		0.71
		(2.95)*

Figures in round brackets are t-statistics, and * and ** denote significance at 5% and 10% level, respectively.

In the short-run, while an unanticipated hike in the policy rate dampens real GDP growth, an equivalent unanticipated cut in the policy rate enhances real GDP growth by a similar magnitude (column 2, table 2). In other words, policy rate shocks have a symmetric impact on real GDP growth. With regard to unanticipated changes in money supply, while an increase in it enhances real GDP growth, a decline has no statistically significant dampening impact (column 3, table 2).

[2] We did not consider M_3, as on casual observation it was found to show perverse relationships such as a negative correlation with inflation.

Table 2: Asymmetric Impact on Output

Variables	Call	M_1
(1)	(2)	(3)
Constant	0.017*	0.017*
	(4.53)	(4.10)
$\sum_{i=1}^{4} y_{t-i}$	-0.066	-0.11
	[0.75]	[0.64]
$\sum_{i=1}^{4} \text{pos}_{t-i}$	**-0.0024****	
	[0.073]	
$\sum_{i=0}^{4} \text{pos}_{t-i}$		**1.17***
		[0.034]
$\sum_{i=1}^{4} neg_{t-i}$	**-0.005***	
	[0.012]	
$\sum_{i=0}^{4} neg_{t-i}$		0.74
		[0.16]
$\sum_{i=1}^{4} \text{pos}_{t-i}$=$\sum_{i=1}^{4} neg_{t-i}$	0.0026	
	[0.25]	
$\sum_{i=0}^{4} \text{pos}_{t-i}$=$\sum_{i=0}^{4} neg_{t-i}$		0.433
		[0.62]

Figures in round and square brackets are t-statistics and probability of chi-square tests, respectively. * and ** denote, significance at 5% and 10% level, respectively.

With regard to the components of aggregate demand, unanticipated hike/cut in policy rate leads to symmetric decline/rise in the growth of investment (column 2, table 3). In contrast, an unanticipated increase/decrease in money supply has no statistically significant impact on investment (column 3, table 3).

Table 3: Asymmetric Impact on Investment

Variables	Call	M_1
(1)	(2)	(3)
Constant	0.029*	0.079*
	(2.56)	(2.28)
$\sum_{i=1}^{2} y_{t-i}$	-0.387*	-1.12*
	[0.044]	[0.00]
$\sum_{i=1}^{4} \text{pos}_{t-i}$	**-0.015****	
	[0.074]	
$\sum_{i=0}^{4} \text{pos}_{t-i}$		0.385
		[0.94]
$\sum_{i=1}^{4} neg_{t-i}$	**-0.025***	
	[0.049]	
$\sum_{i=0}^{4} neg_{t-i}$		7.23
		[0.17]
$\sum_{i=1}^{4} \text{pos}_{t-i}$=$\sum_{i=1}^{4} neg_{t-i}$ 0.009		
	[0.53]	
$\sum_{i=0}^{4} \text{pos}_{t-i}$=$\sum_{i=0}^{4} neg_{t-i}$		-6.85
		[0.39]

Figures in round and square brackets are t-statistics and probability of chi-square tests, respectively. * and ** denote, significance at 5% and 10% level, respectively.

The response of private consumption to monetary policy shocks is quite in contrast to that of investment. An unanticipated hike/cut in the policy rate has no significant impact on private

consumption (column 2, table 4). On other hand, while an unanticipated increase in money supply enhances private consumption in the short-run, a similar unanticipated decrease in money supply has no significant short-run impact on private consumption, implying an asymmetric impact (column 3, table 4).

Table 4: Asymmetric Impact on Private Consumption

Variables	Call	M_1
(1)	(2)	(3)
Constant	0.025*	0.015*
	(5.35)	(2.53)
$\sum_{i=1}^{4} y_{t-i}$	0.683*	-0.88*
	[0.00]	[0.00]
$\sum_{i=1}^{4} \text{pos}_{t-i}$	-0.0027	
	[0.29]	
$\sum_{i=0}^{4} \text{pos}_{t-i}$		**2.63***
		[0.00]
$\sum_{i=1}^{4} neg_{t-i}$	-0.0047	
	[0.20]	
$\sum_{i=0}^{4} neg_{t-i}$		-0.46
		[0.61]
$\sum_{i=1}^{4} \text{pos}_{t-i}=\sum_{i=1}^{4} neg_{t-i}$	0.002	
	[0.65]	
$\sum_{i=0}^{4} \text{pos}_{t-i}=\sum_{i=0}^{4} neg_{t-i}$		**3.09***
		[0.04]

Figures in round and square brackets are t-statistics and probability of chi-square tests, respectively. * and ** denote, significance at 5% and 10% level, respectively.

Government consumption, on the other hand, is not influenced by any of the monetary shocks - neither an unanticipated hike/cut in the policy rate nor an unanticipated increase/decrease in money supply (table 5).

Table 5: Asymmetric Impact on Government Consumption

Variables	Call	M_1
(1)	(2)	(3)
Constant	0.016	0.023
	(1.24)	(0.88)
$\sum_{i=1}^{4} y_{t-i}$	-0.63**	-0.57**
	[0.09]	[0.09]
$\sum_{i=1}^{4} \text{pos}_{t-i}$	0.0033	
	[0.76]	
$\sum_{i=0}^{4} \text{pos}_{t-i}$		-0.104
		[0.98]
$\sum_{i=1}^{4} neg_{t-i}$	-0.017	
	[0.27]	
$\sum_{i=0}^{4} neg_{t-i}$		-1.28
		[0.74]
$\sum_{i=1}^{4} \text{pos}_{t-i}=\sum_{i=1}^{4} neg_{t-i}$ 0.02		
	[0.31]	
$\sum_{i=0}^{4} \text{pos}_{t-i}=\sum_{i=0}^{4} neg_{t-i}$		1.18
		[0.85]

Figures in round and square brackets are t-statistics and probability of chi-square tests, respectively. * and ** denote, significance at 5% and 10% level, respectively.

The impacts of monetary shocks on inflation mirror image those of real GDP growth. An unanticipated hike/reduction in policy rate leads to symmetric decline/rise in inflation (column 2, table 6). As for unanticipated changes in money supply, there is an asymmetric impact on inflation. While unanticipated increase in money supply leads to higher inflation, unanticipated decrease in money supply has no significant impact on inflation (column 3, table 6). These results are consistent with each other. As policy rate shocks have a symmetric impact on real GDP growth (aggregate demand), they also have symmetric impact on inflation. Similarly, asymmetric impact of money supply shocks on real GDP growth (aggregate demand) is reflected on corresponding asymmetric impact on inflation.

Table 6: Asymmetric Impact on Inflation

Variables	Call	M_1
(1)	(2)	(3)
Constant	0.011*	0.005**
	(4.98)	(1.70)
$\sum_{i=1}^{2} \pi_{t-i}$	0.14	0.268*
	[0.22]	[0.037]
$OGAP_{(-1)}$		0.06
		(0.59)
$OGAP_{(-3)}$	0.266*	
	(2.52)	
$\sum_{i=1}^{4} pos_{t-i}$	**-0.0027***	**1.03***
	[0.049]	**[0.016]**
$\sum_{i=1}^{4} neg_{t-i}$	**-0.0056***	-0.29
	[0.006]	[0.29]
$\sum_{i=1}^{4} pos_{t-i}$=$\sum_{i=1}^{4} neg_{t-i}$	-0.003	**1.32***
	[0.23]	**[0.027]**

Figures in round and square brackets are t-statistics and probability of chi-square tests, respectively. * and ** denote, significance at 5% and 10% level, respectively.

V. Conclusion and Policy Inferences

In India, both interest rate shocks and money supply shocks impact real output growth and inflation in the short-run. However, the impact varies between the components of aggregate demand and money supply shocks have an asymmetric impact. These findings have policy inferences. While policy rate shocks could effectively control aggregate demand, and therefore, inflation in the short-run, that the effect works primarily through growth in investment may have implications on real output growth beyond the short-run. Money supply continues to be a relevant monetary policy variable, particularly when it grows beyond the desired level. Therefore, at the current juncture, it may not be desirable to completely disregard money supply in order to maintain policy rate at a targeted level. While policy rate is the main signalling instrument, the need for use of direct instruments and/or limiting access of banks to the central bank for liquidity to regulate the quantum of money supply would still be relevant.

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