

Effectiveness of monetary policy and interest rate pass-through in India since financial sector reforms

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Abstract. *This article tries to investigate how monetary policy and interest rate pass-through is effective in India after adequate autonomy was given to commercial banks through financial sector reforms and Banking Sector Reforms. The study uses Milton Friedman and Robert Mundell's perspectives on the role of monetary policy in achieving internal and external sector equilibrium. For this purpose, the study uses ADF-PP unit root test, Engel Granger's Causality Test and trend line analysis. The study observed that the monetary policy is effective in influencing major macroeconomic variables like GDP, Exports, Imports and Capital Flows. Similarly, the Reserve Bank's Lending Rate and Commercial Banks Prime Lending Rates are directly correlated in the entire study period. But the study did not find any causality between money supply with current account deficit and exchange rate lacks significance of monetary policy in the context of automatic restoration in the external sector. The overall conclusion of the study is that the monetary policy is very effective in influencing major macroeconomic variables via strong interest rate pass-through in India even after adequate autonomy was given to Commercial Banking Institutions.*

Keywords: Money Supply, Interest Rate, Monetary Policy, Capital Movements, Granger Causality.

JEL Classification: E43, E51, E52, E58, F21.

1. Introduction

India revisited the macroeconomic policymaking process since the Balance of Payments crisis of 1991. Before the BOP crisis, almost all the sectors and institutions were directly controlled and regulated by the government and the RBI through appropriate Fiscal and monetary policies, popularly known as inward-looking strategy. After 1991, when the government introduces the outward-looking strategy known as Liberalization, Privatization and Globalisation (LPG), role and the effect of macroeconomic policies on the economy differ drastically. Especially, the effect of monetary policy on the economy invalidates several theoretical relationships. This is mainly because of the government of India undertook major reforms relating to the functions of the money market. The first reform measure was introducing the recommendations of the committee on the financial system in 1991 and the other is banking sector reforms in India in 1998. Both the reform measure delivers adequate freedom in the operation of financial institutions in the money market, especially Nationalised Commercial Banks (NCBs) enjoys more autonomy through deregulation of interest rate and so on. As a result of this, the commercial banks did not respond properly to the RBIs rate cut on several occasions which nurtures serious concern on the effectiveness of monetary policy in India.

Theoretically, the role of monetary policy is an important tool to achieve internal as well as external sector goals. Suppose, if the central bank increases its money supply marginally, it will increase the price level and decrease the interest rate. This, in turn, will have a positive impact on the nation's GDP without creating inflation. Similarly, the explicit control of the quantity of money by the government and the explicit creation of money to meet fiscal deficit will influence inflationary effect in the economy. This problem cannot be rectified with fiscal discipline. Instead, eliminating government control on the quantity of money with the balanced budget will provide a solution to economic fluctuations.

Likewise, monetary policy works well in the external sector, especially the Balance of Payments front. The Balance of Payments problem is always and everywhere a monetary phenomenon (Johnson, 1974). According to Johnson, an increase in money supply which will lead to creating a deficit in the current account as well in the capital account. It can be stated as;

$$\uparrow MS \rightarrow \uparrow D \rightarrow \uparrow I \rightarrow \uparrow GDP \quad (1)$$

$$\uparrow MS \rightarrow \uparrow P \rightarrow \uparrow M \ \& \ \downarrow X \rightarrow -CAD \rightarrow -B \quad (2)$$

Similarly,

$$\uparrow MS \rightarrow \downarrow i \rightarrow \uparrow Kout \rightarrow -KA \rightarrow -B \quad (3)$$

$$-CAD \ \& \ -KA \rightarrow -B \quad (4)$$

Where: MS = Money Supply, CAD = Current Account Deficit, Kout = Capital Outflows, M = Imports, X = Exports, P = Price Level, i = interest rate, KA = Capital Account, B = Balance of Payments.

Just the opposite case will occur when the central bank of the country decreases its money supply.

So monetary policies can be applied to improve or correct disequilibrium in the Balance of Payments under fixed and flexible exchange rate systems. Under a fixed exchange rate system, the BOP is highly monitored and controlled by the Central Bank via accommodating flows. Whereas in the flexible exchange rate system, market forces play a significant role in determining the exchange rate, which in turn corrects BOP disequilibrium automatically through autonomous flows.

In the present scenario, the majority of the countries are following either a flexible exchange rate system or a managed float exchange rate system. So, the present study tries to test the relevance and effectiveness of the monetary policy on major macroeconomic indicators by correlating the RBIs lending rate with commercial banks' lending rate since the reforms in the Indian money market.

Eminent economists like Milton Friedman, Harry Johnson, Mundell-Fleming, David Hume, Michael Mussa and others proved the effectiveness monetary policy in achieving external and internal sector goals, especially GDP growth with price stability, exchange rate stability and equilibrium in the balance of payments. In this context, the present study tries to test the effectiveness of monetary policy on major macroeconomic variables since financial sector reforms. Therefore, the present study attempts to answer the following research questions: To what extent India's GDP responds to the changes in the money supply? Does the change in money supply have any impact on the current account, capital account and overall BOP account? Is there any correlation between the RBIs lending rate with commercial bank's lending rate? How effective the monetary policy is to influence price level, interest rate and exchange rate in India? How effective the monetary policy in solving issues in the domestic economy as well as in the external sector sustainability?

Against the background and research issues, the major objectives of the study is to evaluate the effectiveness of monetary policy in India with a special focus on the financial sector and banking sector reforms. Also, the study aims to analyse the relevance and effectiveness of monetary policy in India concerning external sector sustainability. Finally, the study will attempt to compare the magnitude of change in the RBIs lending rate with nationalized commercial bank's lending rates for interest rate pass-through in India.

2. Review of literature

At the time of Great Depression, particularly during 1929 to 1933, the central banks were collapsed from control by the Treasuries and became mere pointer damsels in the application of cheap money policies. Cheap money policies were aimed initially at curing the depression which they signally failed to do owing to the expected misperception in central banking spheres of factually low-interest rates with strongly expansionary monetary policy-then at securing low-cost war finance, and then at holding down interest rates for

reasons of public debt management and employment maintenance. With the post-war return to increasingly liberal trade and payments system based on convertibility of currencies at fixed exchange rates, however, central banks have rapidly been recovering their influence on economic policy. Their return to power has been based on both the need to use monetary policy as a major weapon of balance-of-payments adjustment, and on the need for coordination and cooperation to achieve domestic employment without much impact on inflation (Johnson, 1968).

Friedman (1948) raised several questions relating to the effectiveness of monetary policy. Some of them are; how important change in the supply of money compared with changes in the demand for money? Are transactions variables most important in determining the demand for money? How elastic is the demand for money with respect to interest rates? When changes in demand or supply occur that produce discrepancies between the quantity of money that the public holds and the quantity it desires to hold, how rapidly do these discrepancies tend to be eliminated? Does the adjustment impinge mostly on prices or mostly on quantities? Is the adjustment to sharp changes over short periods different in kind or only in degree from the adjustment to slower changes over longer periods? For all the above questions, he concluded that full adjustment to monetary disturbances takes a very long time and affects many economic magnitudes. If the adjustment were swift, immediate, and mechanical, as some earlier quantity theorists may have believed, or, more likely, as was attributed to them by their critics, the role of money would be clearly and sharply etched even in the imperfect figures that have been available. But, if the adjustment is slow, delayed, and sophisticated, then crude evidence may be misleading, and a more suitable examination of the record may be needed to disentangle what is systematic from what is random and erratic.

Mussa (1974) tested the efficacy of the monetary approach to Balance of Payments analysis. The study set forth the most relevant and important principles of monetary policy and tested the same in a simple model of trade and payment behaviour. The study found that the money demand function and the money supply process plays a central role in the balance of payments analysis, especially in the long run. The study concludes stating that the monetary approach is not identified with the view that "only money matters", nor is it asserted that the monetary approach is encompassed in any single, specific, theoretical model.

Frenkel, Gylfason and Helliwell (1980) correlated Monetary and Keynesian approaches and found the difficulties of empirical estimation in the short run. They contrasted some principles of the Monetary and Keynesian approach and reformulated a more general model by taking essential features of both. The study observed that long term modelling is required to test the composition and growth of foreign and domestic portfolios. The short term model paid no attention to evaluate the role and expectations concerning interest rate, prices, GDP, taxes, government expenditure and so on. A more complete analysis would have to incorporate these features within modelling that considers the long-run effect.

Frenkel and Mussa (1981) examined the role of monetary and fiscal policies in the context of the open economy. The main focus of the study is to trace out the effectiveness and proper conduct of macroeconomic policies in achieving the national objectives. The study uses approaches of James Meade, Robert Mundell and Marcus Fleming's ideologies to test the effectiveness of macroeconomic policies in open economies. They observed no country is immune from disturbances originating in the rest of the world, and no government can sensibly conduct its macro-economic policy on the assumption that it operates in a closed economy. They also observed that they found that the absence of long-run money illusion and consistency of expectations which impose important constraints on the conduct of macro-economic policy in the open economy.

Ray, Partha, Joshi, R., Himanshu, Saggarr, Mridul (1998) explored the monetary transmission mechanism in the liberalisational era in the context of financial sector reforms. The study tried to examine the role of interest rate and exchange rate in the conduct of monetary policy. The long-run relationship between money, prices, output, and the exchange rate is observed. The study found that the Interest rates and exchange rates are seen to be endogenously determined since financial sector reforms and it increases the possibility of the change in transmission mechanism following the advent of financial sector reforms.

Numerous measures were taken to enhance the effectiveness of monetary policy in India under economic reforms and these include improvement in the payment and settlement systems, improvement of a secondary market in government securities with portfolio diversification in the interest of investor, reduction in non-performing assets and reduction in the overall transactions costs. In recent times, the RBI initiated several steps to develop the money market. Financial sector reforms and banking sector reforms may not have the desired results with commendable fiscal adjustment (Reddy, 1999)

Joshi (1999) found that the banking sector reforms has been an overemphasis on profits and virtually neglected the distributive role of the banks. They also observed that the strong and high net worth companies within the organised sector are capable of raising funds at a considerably lower rate of interest, while the credit disbursal to small borrowers has sharply declined.

Mohanty and Mitra (1999) observed that the monetary targeting exercise produced mixed results for India. They found that the expansion of money supply emanating from monetisation of government deficit capital flows rendered the control of monetary aggregates difficult. With the increasing market orientation of the financial structure and international capital flows, it is necessary to follow the monetary targeting approach which could ensure internal and external stability.

Kanagasabapathy (2001) observed monetary policy underpinnings in India over several decades. He also points out the limitations and constraints in pursuing monetary policy objectives and throws light on current mainstream economic thinking and perspective in the context of the changing economic environment worldwide. The study found that the

emergence of the interest rate as an efficient variable in the transmission mechanism, the RBI has begun placing greater reliance on Liquidity Adjustment Facility (LAF), especially OMO, Repo, Bank rate, etc., instead of the dependence on CRR alone. Another issue debated in the context of Central Bank autonomy is the separation of debt management and monetary management functions. At the same time, it would require a co-ordinated operation with monetary management to achieve a stable interest rate environment and market condition.

Monetary policy is increasingly focused on Dreze and Sen's view of growth mediated security helps to achieve monetary objectives including price stability and GDP growth will lead to alleviate poverty indirectly. Monetary and financial sector policies in India should perhaps be focusing increasingly on both inflation and GDP growth (Reddy, 2002).

Shankar (2002) witnessed that the practice of monetary policy has clearly undergone a sea change during the nineties but it was more sophisticated later by giving further autonomy to money market institutions. However, several earlier problems and dilemmas were persisted even after the 90s. In particular, the effectiveness of monetary policy continued to be defective due to expansionary fiscal policy as well as an insufficiently responsive financial system.

Nachane and Lakshmi (2002) observed significant influences of money, monetary policy transmission and on the demand for money. They studied various issues about the instability of the relationship between monetary aggregates and their impact on the macro-economy. The financial change is indeed invoking fundamental alterations along these lines, then they would be manifested in at least certain quantifiable dimensions observed by Nachane and Lakshmi.

Jalan (2002) found that there has been a progressive intensification of financial sector reforms, and the financial sector as a whole is more sensitized than before. At the same time, because of greater disclosure and with tougher prudential norms, the weaknesses in our financial system are more apparent than before. The structure of the financial system is changing and in a fundamental sense regulators and supervisors are under the greatest pressures of change and bear the larger responsibility for the future, observed by Jalan.

Fathima and Iqbal (2003) tested the effectiveness of monetary policy and fiscal policy for economic growth in five Asian economies which include India, Pakistan, Thailand, Malaysia and Indonesia. The study found unidirectional causality between monetary policy and economic growth in India.

Indranil and Partha (2007) assessed the monetary policy stance by observing various monetary policy announcements in India from 1973 to 1998. This study used a Vector Auto-Regressive (VAR) framework and found that the monetary policy seemed to have been more effective in price control than output growth. The impulse response from the VAR model depicted the success of monetary policy in inflation control rather than on GDP reflecting proactive monetary management in a regulated environment. So the study

recommended the necessity of future analysis of monetary policy in the pre and post the 90s to trace causal impact on growth-inflation trade-off.

Amaresh (2009) focused RBIs multiple indicator approaches in the conduct of monetary policy since April 1998. Amaresh developed a monetary policy index by synthesising the extracted signals from the policy documents and quantitative information embedded in key indicators. The constructed monetary policy index was used to assess the impact of monetary policy on macroeconomic variables such as interest rates, bank credit, inflation, and output growth during the post-reform period. The study observed that the monetary policy has an instant influence on interest rates, the impact on inflation and output was realised with a lag of around 6 to 18 months.

Hutchison Rajeswari and Nirvikar (2010) investigated the applicability of the discretionary monetary rule of the Reserve Bank of India concerning Taylor-type rule. The study estimated an exchange-rate-augmented Taylor rule for India for a period of 28 years from 1980 to 2008. The study compares monetary policy effects during the pre- and post-liberalisation periods to capture the potential impact of macroeconomic structural changes on the RBI's monetary policy conduct. The study found that the output gap appears to be important to RBI rather than consumer price inflation and exchange rate changes.

Yogita and Jasmit (2015) examined the factors that are responsible for the inflation rate in India. They also focused on the role of monetary policy in controlling inflation rate. The study used time series data and Granger causality test to check the causal relationship between monetary instruments and inflation. The study found mixed implications from the multivariate linear regression model. Which means, the monetary policy is not the only variable that controls the inflation rate in India

Rakesh and Partha (2018) provides a narrative of the effectiveness of monetary policy in India since the financial crisis of 2008. They observed that the policymakers used monetary and fiscal stimuli during 2009-2013, prompted by the financial crisis. The study also observed that in recent years, the monetary policy-making process in India has been dominated by two main events. One is a significant fall in the public sector balance sheet and the other is demonetization effect. The study concluded by stating that the monetary policy in both periods is wrestled with the appropriate strategy for regulating impossible trinity.

Vasudevan (1997 and 1998), provides an illuminating discussion on the dilemma faced in monetary policy-making in a transitional setting. Vasudevan recommended a meaningful analysis that looks beyond the issue of stability of the money demand function in judging an appropriate framework of monetary policy for India.

Several eminent economists tested the effectiveness of monetary policy in the economy with respect to openness of the economy, fixed and flexible exchange rate system and so on. Mundell (1968, 1971), Mc Kinnon (1968), Frenkel (1971), Johnson (1968, 1972, 1977), Swaboda (1973) and Mussa (1974) are the significant approaches that evaluated the effectiveness of monetary policy in the context of internal and external equilibrium.

According to Mundell, Johnson and Frenkel, monetary policy is more effective under the conditions of openness and a flexible exchange rate system.

The government of India introduced several liberalisational measures in the banking system under financial sector reforms in 1991 and banking sector reforms in 1998. They also introduced a flexible exchange rate system under LERMS in 1992 (Liberalised Exchange Rate Management System). In this context, the present study tries to estimate the effectiveness of monetary policy and interest rate pass-through in India since major reforms in the money market.

3. Research methodology

The present study attempts to analyse the effectiveness of monetary policy and interest rate pass-through in India since major reforms in the Indian Money Market. For this purpose, the study uses both descriptive statistics and empirical analysis. First, the study uses Augmented Dickey-Fuller (ADF) test to check whether the data set is stationary or non-stationary. After checking stationarity conditions, the study will apply the Granger causality test for directional relationships. Finally, trend line analysis will be applied to verify causality results and other supportive information. All the estimations and analysis will be done by using E-Views software, 8th version.

The study first applies ADF test for each of the variables by using the following sequential testing procedure.

$$\Delta X_t = \alpha + \beta X_{t-1} + \sum_{i=1}^p \varphi_i \Delta X_{t-1} + \lambda t + u_t \quad (5)$$

If $\beta = 0$, meaning that the selected variable X_t contains unit root and the data is not stationary. Therefore, it is highly necessary to include t (deterministic) into the equation. In this analysis, if the trend is stationary and statistically significant, then only the study can perform the econometric technique for analysis.

In the Granger Causality Test, the directional relationships between two variables are very sensitive which can be used efficiently by using an appropriate number of lags in the model. It can be inferred from the computed statistical values, based on the given equations, if the beta coefficients become zero or less than the conventional value of 0.05 and the computed F statistic is low for the first hypothesis in the equation (1) indicate that the lagged MS do not possess in the regression (accepting null hypothesis). This means Money Supply in India does not Granger cause GDP, similarly for other beta coefficients in the first hypothesis of the rest of equations. When we move to the second hypothesis which states that the GDP does not Granger cause Money Supply in India if the computed F statistic is low or P-value is less than the conventional value, we can reject the hypothesis and infer that the GDP does not Granger cause Money Supply in India. Similar results can be derived for other beta coefficients in the second hypothesis of the rest of the equations.

Granger causality test is used to check the effectiveness of monetary policy and interest rate pass-through in India. To check causality between the changes in Money Supply in India with GDP, lending rate, exchange rate and BOP variables, the following model developed by Engel and Granger (1987) will be used. The models are:

(a) *Money supply and Gross Domestic Product (GDP) in India*

$$MS_t = \beta_0 + \sum_{i=1}^n \beta_{1i} MS_{t-i} + \sum_{i=1}^n \beta_{2i} GDP_{t-i} + u_{1t}$$

$$GDP_t = \beta_3 + \sum_{i=1}^n \beta_{4i} GDP_{t-i} + \sum_{i=1}^n \beta_{5i} MS_{t-i} + u_{2t} \quad (6)$$

(b) *Money supply and current account deficit in India*

$$MS_t = \beta_0 + \sum_{i=1}^n \beta_{1i} MS_{t-i} + \sum_{i=1}^n \beta_{2i} CAD_{t-i} + u_{1t}$$

$$CAD_t = \beta_3 + \sum_{i=1}^n \beta_{4i} CAD_{t-i} + \sum_{i=1}^n \beta_{5i} MS_{t-i} + u_{2t} \quad (7)$$

(c) *Money supply and capital outflows from India*

$$MS_t = \beta_0 + \sum_{i=1}^n \beta_{1i} MS_{t-i} + \sum_{i=1}^n \beta_{2i} KO_{t-i} + u_{1t}$$

$$KO_t = \beta_3 + \sum_{i=1}^n \beta_{4i} KO_{t-i} + \sum_{i=1}^n \beta_{5i} MS_{t-i} + u_{2t} \quad (8)$$

(d) *Money supply and exchange rate in India*

$$MS_t = \beta_0 + \sum_{i=1}^n \beta_{1i} MS_{t-i} + \sum_{i=1}^n \beta_{2i} ER_{t-i} + u_{1t}$$

$$ER_t = \beta_3 + \sum_{i=1}^n \beta_{4i} ER_{t-i} + \sum_{i=1}^n \beta_{5i} MS_{t-i} + u_{2t} \quad (9)$$

(e) *Money supply and commercial bank lending rate in India*

$$MS_t = \beta_0 + \sum_{i=1}^n \beta_{1i} MS_{t-i} + \sum_{i=1}^n \beta_{2i} CBLR_{t-i} + u_{1t}$$

$$CBLR_t = \beta_3 + \sum_{i=1}^n \beta_{4i} CBLR + \sum_{i=1}^n \beta_{5i} MS_{t-i} + u_{2t} \quad (10)$$

(f) Money supply and inflation rate in India

$$MS_t = \beta_0 + \sum_{i=1}^n \beta_{1i} MS_{t-i} + \sum_{i=1}^n \beta_{2i} CPI_{t-i} + u_{1t}$$

$$CPI_t = \beta_3 + \sum_{i=1}^n \beta_{4i} CPI + \sum_{i=1}^n \beta_{5i} MS_{t-i} + u_{2t} \quad (11)$$

(g) Reserve bank lending rate and commercial bank lending rate in India

$$RBLR_t = \beta_0 + \sum_{i=1}^n \beta_{1i} RBLR_{t-i} + \sum_{i=1}^n \beta_{2i} CBLR_{t-i} + u_{1t}$$

$$CBLR_t = \beta_3 + \sum_{i=1}^n \beta_{4i} CBLR + \sum_{i=1}^n \beta_{5i} RBLR_{t-i} + u_{2t} \quad (12)$$

Where, MS = money supply, CAD = Current Account Deficit, KO = Capital Outflows, ER = Exchange Rate, CBLR = Commercial Bank Lending Rate, RBLR = Reserve Bank Lending Rate, CPI = Consumer Price Index.

4. Empirical results

To analyse the effectiveness of monetary policy and interest rate pass-through in India, the study uses both empirical analysis and descriptive statistical techniques. For empirical analysis, the study first uses Augmented Dickey-Fuller and Philips Perron's unit root test for stationarity conditions. After detecting stationary conditions, the study will apply Engel-Granger's Causality test. Finally, the empirical results will be compared and verified with the trend line analysis using growth rates of respective variables used in the empirical model.

The Augmented Dickey-Fuller and Philips-Perron unit root test are conducted for Money Supply, Current Account Deficit, Inflation, Exports, Imports, Exchange Rate, Commercial Bank's Prime Lending Rates, Reserve Bank's Lending Rate, Capital Outflows, GDP, Growth Rate of Money Supply, Exchange Rate Growth and GDP Growth. The unit root test is conducted for trend and intercept at a level and first difference.

Table 1. *Unit Root Test*

Variables	Augmented Dickey-Fuller Test (Trend & Intercept at first difference)		Phillips-Perron Test (Trend & Intercept at first difference)	
	T Statistic	Prob	T Statistic	Prob
Money Supply	-2.7248	0.2362	-5.0424	0.0023
Current Account Deficit	-4.5345	0.0070	-4.5345	0.0070
Commercial Bank (PLR)	-5.3644	0.0011	-5.3737	0.0011
CPI Inflation	-6.4522	0.0001	-6.4522	0.0001
Exchange Rate	-5.4046	0.0010	-5.4046	0.0010
Exports	-4.4707	0.0081	-4.5158	0.0073
Imports	-3.4691	0.0649	-3.4976	0.0615
Capital Outflows	-0.8012	0.9474	-4.6360	0.0056
RBI Lending rate	-5.2694	0.0015	-7.5906	0.0000
Money Supply growth rate	-6.2469	0.0002	-16.592	0.0000
GDP growth rate	-7.9585	0.0000	-10.404	0.0000
GDP	-2.2924	0.4225	-2.2894	0.4240
Exchange rate growth	-5.8630	0.0004	-15.444	0.0000

Source: Computed.

The ADF and PP unit root test results are given in Table 1. Due to space constraints, the study displays the only trend and intercept values at the first difference in the table. The study observed that the selected variables are non-stationary at a level. But, it is clear from Table 1 that almost all the selected macroeconomic variables are stationary at first difference.

The ADF test result shows that the probability value for all the selected variables is less than 0.05 except a few variables like money supply, imports, capital flows and GDP. But the test statistic value for the same variables are less than the critical value at 1 percent and 5 percent leads to the rejection of the null hypothesis and infers that the variables have no unit root. Likewise, the PP unit root test is also observed almost similar results with slight variations. The PP test pointed out a low probability value (less than 0.05 percent) for all the variables except imports and GDP. Here also the observed test statistic values for imports and GDP are less than the critical value of 1 percent and 5 percent. So we reject the null hypothesis and infer that the variables have no unit root. After fulfilling the stationarity conditions from Table 1, the study focuses on the application of Engel-Granger's Causality test for a directional relationship between the selected variables.

The main aim of the study is to test the effectiveness of monetary policy and interest rate pass-through in India. The purpose is to check how effective the RBI's monetary policy is in influencing internal and external sector variables. It can be tested using periodical changes in money supply and its effect on GDP, Current Account Deficit, Capital Flows, Exchange Rate, Lending Rate of RBI and Commercial Banks. Usually, these variables have bi-directional and unidirectional relationships. Some variables may not have any associations. For example, an increase in the money supply leads to an increase in demand for goods and price levels. Similarly, an increase in price level may influence the circulation of money by reducing bond demand is called bidirectional causality. If the increased money supply leads to create only inflation (price level) and no impact in the bond market is called unidirectional causality. For this purpose, the appropriate model is Engel-Granger's Causality test which is applied in this study for analysis.

Table 2. *Pairwise Granger Causality Tests*

Null Hypothesis	Obs	F-Statistic	Prob.	Result
GDP does not Granger Cause MS	25	0.60213	0.5573	Unidirectional Causality
MS does not Granger Cause GDP		4.20044	0.0300	
IMP does not Granger Cause MS	25	2.24861	0.1316	Unidirectional Causality
MS does not Granger Cause IMP		10.1886	0.0009	
EXP does not Granger Cause MS	25	1.32295	0.2887	Unidirectional Causality
MS does not Granger Cause EXP		5.08933	0.0163	
CAD does not Granger Cause MS	25	2.88111	0.0795	No Causality
MS does not Granger Cause CAD		1.66592	0.2142	
KOUT does not Granger Cause MS	25	0.08953	0.9147	Unidirectional Causality
MS does not Granger Cause KOUT		4.85208	0.0191	
EXC does not Granger Cause MS	25	0.11754	0.8897	No Causality
MS does not Granger Cause EXC		1.82798	0.1866	
CBPLR does not Granger Cause MS	25	0.57815	0.5700	No Causality
MS does not Granger Cause CBPLR		2.70186	0.0915	
CPI does not Granger Cause MS	25	1.88630	0.1776	No Causality
MS does not Granger Cause CPI		0.11976	0.8878	
RBLR does not Granger Cause CBPLR	25	5.11693	0.0160	Unidirectional Causality
CBPLR does not Granger Cause RBLR		1.93622	0.1703	

Source: Computed.

Theoretically, the effectiveness of monetary policy can be tested using two methods. The first method deals the internal sector by assessing the effect of changes in money supply on Demand, Employment and GDP without creating inflation in the economy. The second method deals the external sector by assessing the effect of changes in Money Supply on Exports, Imports, Capital Flows, Current Account Deficit, Exchange Rate and Balance of Payments. These theoretical linkages are converted and given in an equation form in this study. They are the equation (1), (2), (3) and (4) of this study.

Now, the study uses pairwise Granger Causality test results from Table 2 to verify the relevance and effectiveness of monetary policy via (1), (2), (3) and (4). Granger Causality test result from Table 2 gives unidirectional causality between Money Supply and GDP in India. The probability value of 0.03 rejected the null hypothesis of the money supply does not Granger cause GDP. This means the test result validated the theoretical relationship given in equation (1) that an increase in money supply leads to an increase in GDP. Figure 1 is also supported that there is a positive relationship between the money supply and GDP in India. It can also be inferred from Figure 1 that an increase in money supply increases GDP via aggregate demand without creating an inflation rate in India. It is evidenced from Figure 2 and Granger Causality, both results of no causality between money supply and the Inflation rate in India. Also, the test result reveals the GDP does not influence the money supply. Naturally, the money supply is exogenously determined by the central bank.

Figure 1. Correlation between the growth rate of money Supply with GDP Growth

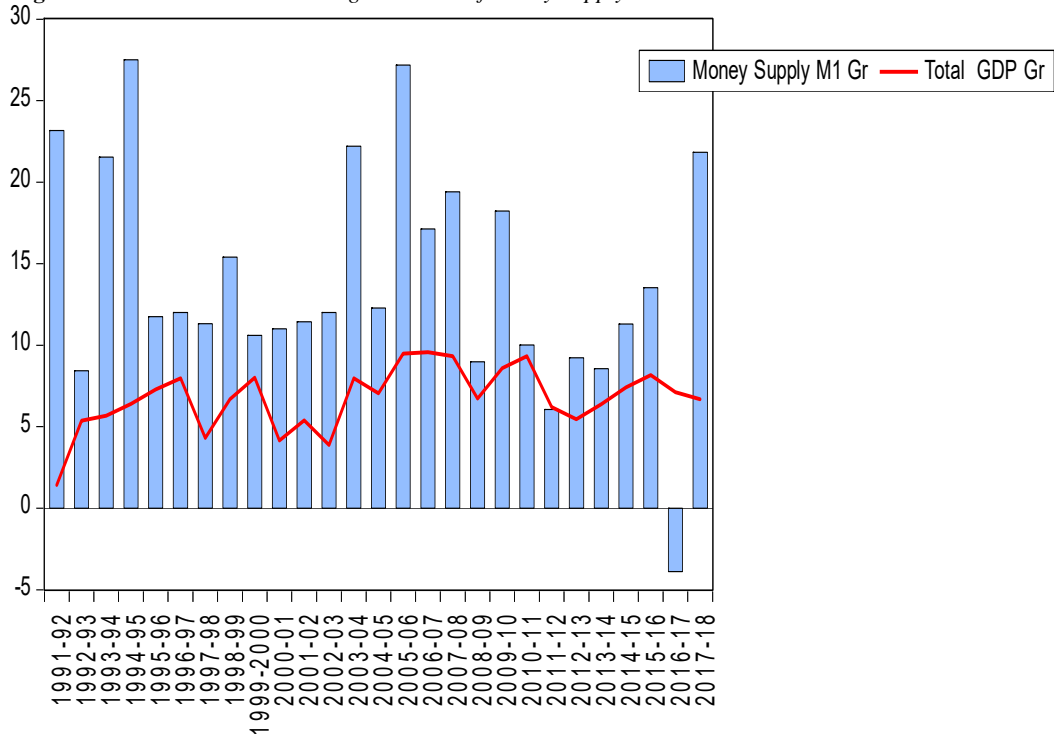


Figure 2. Correlation between the growth rate of money Supply with Inflation

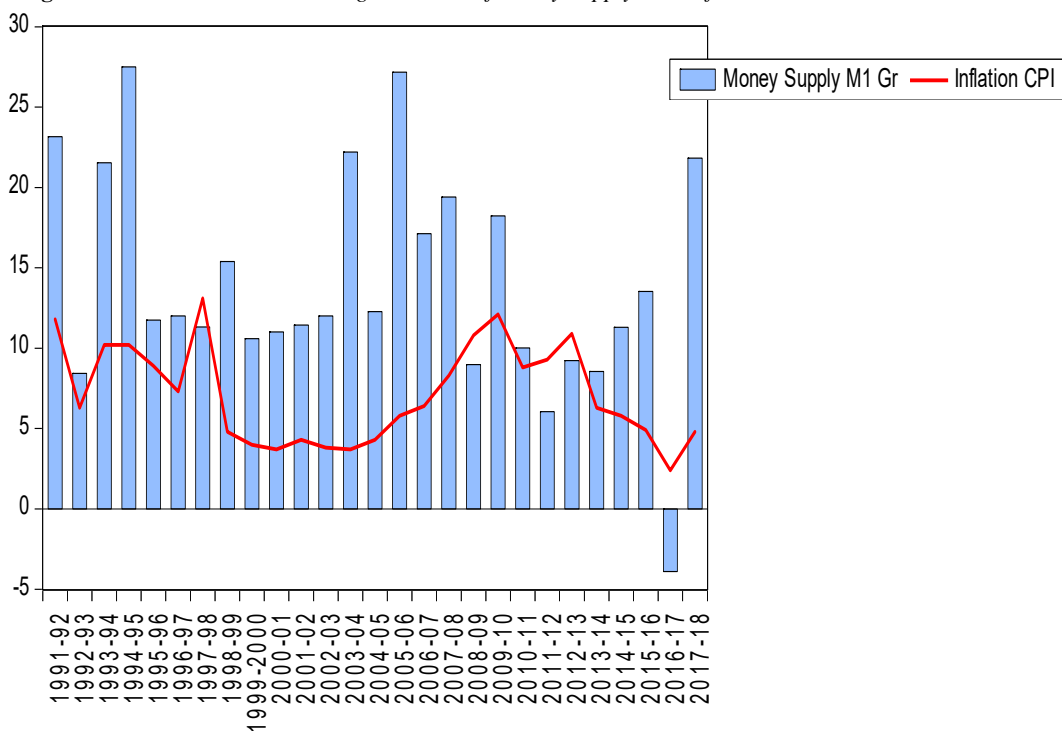


Figure 3. Correlation between the growth rate of money Supply with Exchange Rate (y-o-y)

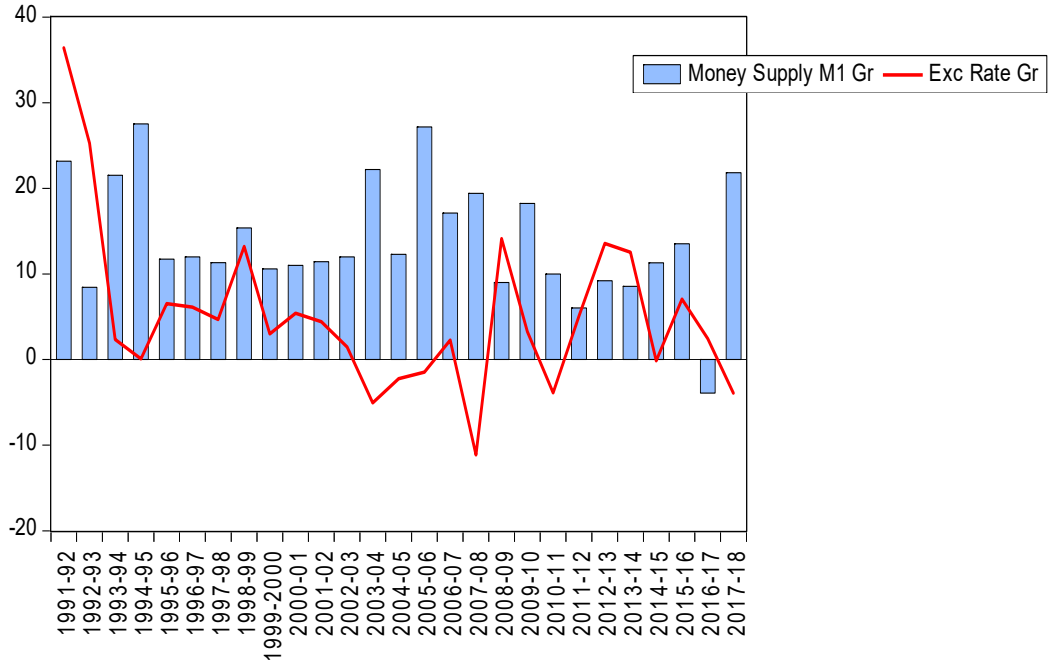
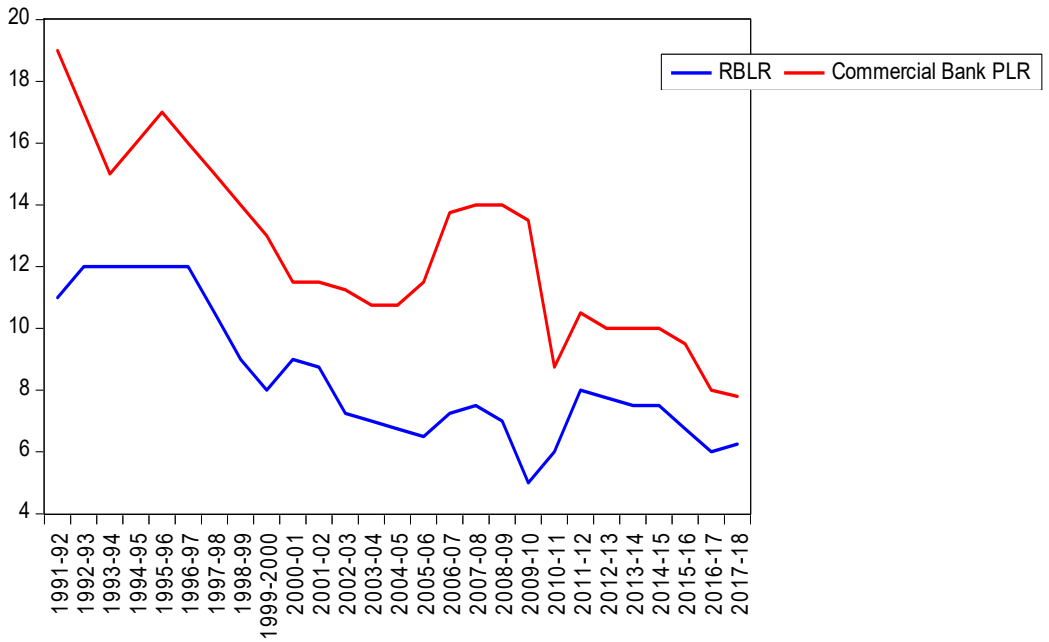


Figure 4. Correlation between the RBI Lending Rate with Commercial Bank Lending Rate



When we move to the external sector, the study found a very interesting result that validated the effectiveness of the money supply/monetary policy. It is seen from Table 2 that the money supply has unidirectional causality with exports, imports and capital outflows. Theoretically, an increase in money supply leads to increase imports, capital outflows and decrease exports which are given in the study in the form of equation (2) and (3). This study observed unidirectional causality for the same variables validated equation (2) and (3). But the study did not find any causality between money supply and current account deficit. It means the role of invisible (service trade) plays a crucial role in India's current account than that of merchandise account. Unexpectedly, it is found from Table 2 and Figures 2 and 3 that the change in the money supply does not influence the exchange rate and inflation rate. This is the reason why the money supply has no causality with a current account deficit. As a result of this observation, the restoration process in Balance of Payments is not feasible for India. From these results, it can be inferred that the monetary policy is effective in influencing major variables in the external sector but it is not effective in restoring the disequilibrium in Balance of Payments account.

Now the study focuses on the effectiveness of interest rate pass-through in India, especially since financial sector reforms. For this purpose, the study uses money supply, Reserve Bank's Lending Rate (RBLR) and Commercial Bank's Prime Lending Rates (CBPLR). First, the study tested the relationship between CBPLR and money supply. Usually, the money supply is determined exogenously by the central bank of the country and not by CBPLR. The Granger causality test result gives a 57 percent p-value for CBPLR and money supply proved that the money supply is exogenously determined by the RBI and not by CBPLR. When the study tries to estimate another directional relationship between money supply and CBPLR, the study detected a 10 percent level of significance. This means, CBPLR not only depends on RBLR, also it responds to changes in the money supply at a 10 percent level of significance. i.e., demand and supply of money also determine CBPLR instead of only RBLR. Secondly, the Granger causality test result gives unidirectional causality between RBLR and CBPLR. It means any change in RBLR will cause changes in CBPLR. It is also evidenced in Figure 4 that the RBLR and CBPLR move almost in the same direction in the entire study period. From 1991 to 2011, the gap between CBPLR and RBLR was high, but in recent years, the gap is also reducing and moving towards the same direction proved the effectiveness of interest rate pass-through in India.

Conclusion

Financial sector reforms in 1991 and Banking sector reforms in 1998 gave adequate autonomy to the commercial banks and other money market institutions for liberty in decision makings. Due to this, the commercial banks did not properly respond to the rate cut of RBI on several occasions. As a result, the question arises whether the monetary policy and interest rate pass-through is effective in India or not. Especially, since financial sector reforms and Banking sector reforms. For this purpose, the study tries to test the effectiveness of monetary policy and interest rate pass-through in India in the

liberalisational era. The study found mixed implications for monetary policy effectiveness and interest rate pass-through in India. First, the study observed that the expansionary monetary policy influences GDP positively without creating inflation in India. It is evidenced in Figure 1 that the GDP growth rate is associated with the growth rate of money supply and inflation is not responding to the money supply in Figure 2. From this observation, the study infers that the monetary policy is an effective tool to achieve internal equilibrium in India. Secondly, the expansionary monetary policy has unidirectional causality with imports, exports and capital outflows proved the effectiveness of monetary policy in the external sector too. But the study observed that the money supply has no causality with the current account deficit and the exchange rate lacks the significance of monetary policy in the context of an automatic restoration process. Thirdly, the study observed an interesting result for interest rate pass-through. The Granger causality test result provides unidirectional causality between Reserve Bank's Lending Rate and Commercial Bank Lending Rate. This means, even though adequate autonomy was given to commercial banks, their lending rates are directly correlated to Reserve Bank's lending rate proved that there is a strong interest rate pass-through takes place in the organized money market in India. Finally, the study concludes by inferring that the monetary policy is effective in India in terms of achieving internal equilibrium via a strong interest rate pass-through. It also effectively influences exports, imports and capital flows but fails in the process of automatic restoration in the external sector. So, the study suggested that the Reserve Bank of India should strictly follow Friedman's monetary rule instead of discretionary monetary policy induced by the ministry of finance.

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