Role of Money in Determining Output and Prices of the Indian Economy

Sudipta Jha
Assistant Professor
Department of Economics, Vidyasagar University, West Bengal

Ataur Rahman
Ph.D. Scholar
Department of Economics, Vidyasagar University, West Bengal

Abstract

The study has empirically examined the relationship between money, price and output of the post-FRBM Indian economy, i.e., from the first quarter of 2003-2004 to the second quarter of 2019-2020, to see whether there exists any strong evidence of demand-pull or money driven inflation in India. Also, it has examined how the output is being affected by the money supply during the study period. The study has found that inflation in the Indian economy is basically cost-push in nature and a positive relationship between output, inflation, FDI and interest rate is found during our study period. So, we can suggest that given the complex and multidirectional relationships among the macro variables, a multiple indicator approach was better to respond to economic fluctuations than inflation-targeting regime of monetary policy.

Keywords: *Money, Price, Output, Monetary policy*

JEL Classification: *E30, E42, E52*

I. Introduction

Understanding the relationship between monetary and real variables in an economy is at the centre of macroeconomic study. This is first, because without having any hint on the relationship, it is impossible to conduct any macro-stabilising programme whether it is the fiscal or the monetary policy. Secondly, it is still an unresolved research issue, both theoretically and empirically. There are numerous studies on this subject, especially on the relationship between money, price and output in an economy. On this issue, the age-old quantity theory of money states that changes in money supply only affects the price level as output always remains at its full-employment level. On the contrary, Keynesians believe that money supply can affect the aggregate demand and thus output through the changes in interest rate, when price level does not change proportionally[2]. But, the monetarists school of

[2]This is the view on which India's present monetary policy framework is based upon: the framework aims at setting the policy (repo) rate based on an assessment of the current and evolving macroeconomic situation; and modulation of liquidity conditions to anchor money market rates at or around the repo rate. This change in Repo rate transmit through the money market to the entire financial system, which, in turn, influences aggregate demand – a key determinant of inflation and growth (given in the section-*Monetary Policy Framework* in RBI's website).

economics, led by Milton Friedman, states that monetary authority by changing the level of money supply can affect output only in the short-run, though the channel through which it affects output is very much different from that of the Keynesians. According to the monetarists, money supply affects the output as all economic agents, especially non-producer group, cannot fully understand the changes in the price level along with the change in money supply and thus it becomes profitable on the part of the producer to increase their production as real wages falls. But in the long-run when all economic agents discover the true level of all the real variables, then labour supply function also get adjusted and thus output returns to its long-run equilibrium level. There are also many other theoretical possibilities proposed by other different schools of thought, like new-classical or -Keynesian, rational expectations etc. Among them, most striking relationship was proposed by the school of rational expectations who along with all the classical assumptions, also believe that economic agents holds rational expectations about the future i.e., people do not make any systematic errors in evaluating the economic environment. So, there is no possibility that some of the economic agents do not understand the changes in price level due to changes in money supply, even in the short run. Thus fully nullify the possibility of the monetary authority's ability to affect the level of output in the short run as proposed by the monetarists. According to this theory only monetary shock can affect the real economy. We can see Mishkin (1995) where different channels through which monetary policy can affect the output proposed by various schools of thought.

So, from the above we can say that theoretically still there is a debate on whether along with price, money can also affect output. But, at the practical level of policy making, we can see world-wide the importance of monetary policy over and above the fiscal policy particularly after 1970s.Here it is noteworthy that Reserve Bank of India (RBI) has also changed its policy objective towards price stability in 2015, indicating a clear one-to-one correspondence between money and price.

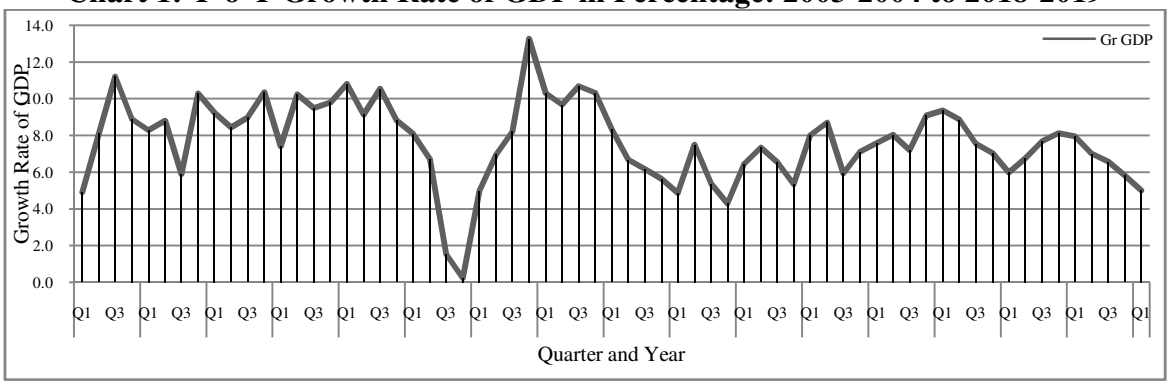
With this backdrop, in the present study we are trying to understand the relationship between money, price and output for the Indian economy from an empirical point of view. For this purpose we have chosen the period 2003-04 to 2018-19. Because, in 2003, Govt. of India enacted the Fiscal Responsibility and Budget Management (FRBM) Act by which the monetary policy became independent of fiscal policy. The Act prohibits automatic monetization of government deficit through direct selling of bonds by the government to RBI. This is an important junction because the interrelationship between money, price and output was more complicated when money supply was endogenous to accommodate the fiscal deficit (see Rangarajan (1990) for the detail analysis).

The study is organised as follows: section II provides a brief analysis of the changes in money, prices and output in Indian Economy during the study period. From this we can make some conjecture on the nature of the relationship between money, prices and output in India. Then section III gives the literature review and present the literature gap. Section IV is devoted to the data and methodology. Section V present the empirical analysis while section VI concludes.

II. Analysis of the Changes in money, prices and output in the Indian Economy: 2003-04 to 2019-20

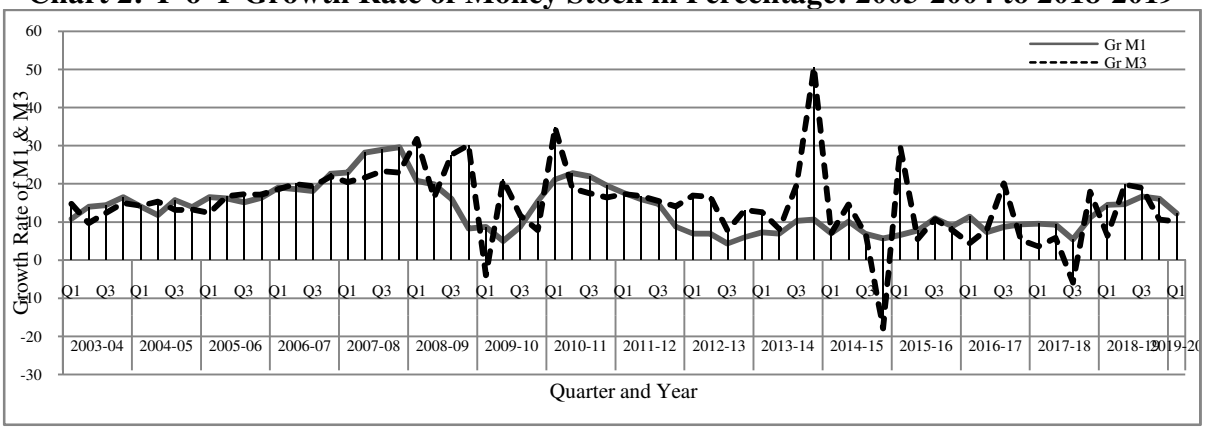
To analyse the effect of money on prices and output first we look at the following three charts, namely 1, 2 and 3 depicting the growth rates of output, money supply and prices respectively.

Chart 1: Y-o-Y Growth Rate of GDP in Percentage: 2003-2004 to 2018-2019



Source: Calculated from RBI's Database.

Chart 2: Y-o-Y Growth Rate of Money Stock in Percentage: 2003-2004 to 2018-2019

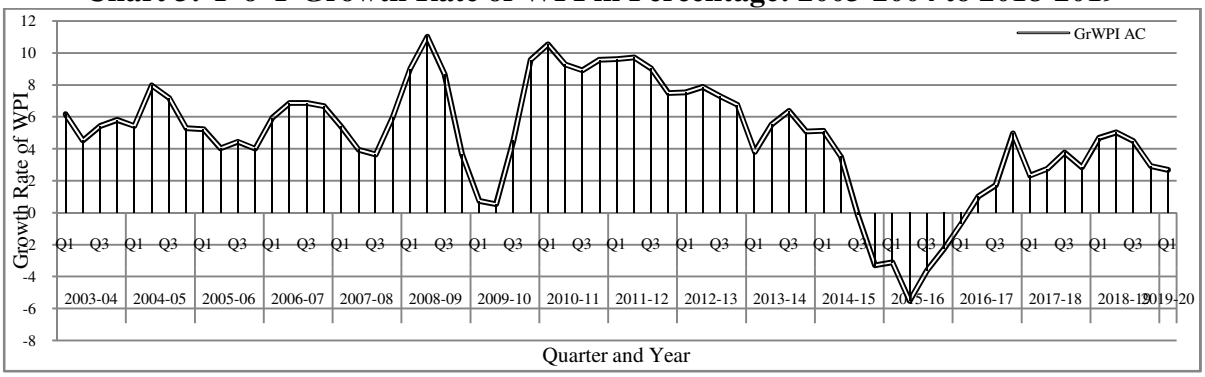


Note:1. M_1 (Narrow money) =Currency with public + demand deposit with commercial bank + other deposit with RBI

2. M3 (Broad money) = M_1+ + time deposit at commercial bank

Source:Calculated from RBI's Database.

Chart 3: Y-o-Y Growth Rate of WPI in Percentage: 2003-2004 to 2018-2019



Source: Calculated from RBI's Database.

From chart 1, we can see the GDP growth rate was remarkably high up to 2007-08, dipped during 2008-09 and then recovered again in 2010-11 but could not able to achieve the high growth phase as it was during 2003-04 to 2007-08.
The growth rate of money supply, shown in Chart 2, also follows the same path: it was increasing up to 2007-2008 and then following two successive declines it became near stagnant from Q_3 of 2012-2013.

But the chart 3 shows, on an average, the WPI Inflation follows a volatile path ranging from 4 to 11 per cent up to 2007-2008 and after recovering from the crisis during 2008-2009 to 2009-2010, it started to decline continuously up to the mid of 2014-2015. Now, it is hovering around 4 per cent.

Now, we know that among the different components of GDP, investment is the most volatile and if we subdivide our whole study period into two-subgroups, pre- and post-crisis period[3], then we can see from the following table 1 that it was investment which can be considered the reason behind the slowdown of the GDP. So, the role of money supply in determining the GDP cannot be ignored as it can directly affect the investment through bank credit[4].

Table 1: Average Contribution to GDP Growth: 2003-04 to 2017-18

Figures are in %.

	PFCE	GFCE	GFCF	Change in Stock	Export of goods & Services	Import of goods & Services
Average of 2003-04 to 2007-08	4.4	0.8	4.7	1.3	3.4	4.4
Average of 2010-11 to 2017-18	4.2	0.7	2.1	0.2	1.7	1.5
memo: % share in GDP						
Average of 2003-04 to 2007-08	58.9	10.7	29.6	2.7	18.7	21.2
Average of 2010-11 to 2017-18	57.8	11.3	29.5	1.8	22.2	26.2

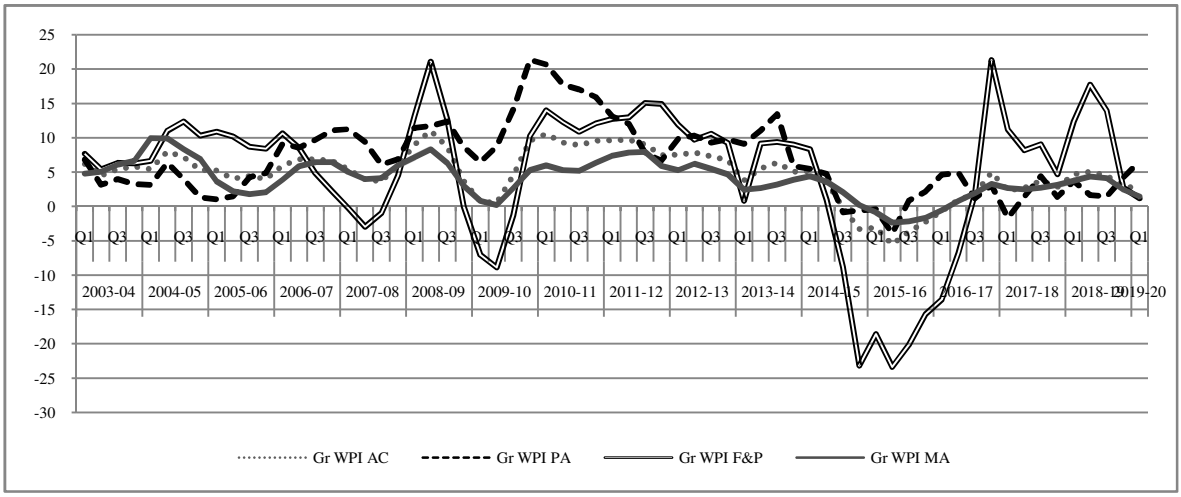
Note: PFCE:Private Final Consumption Expenditure, GFCE:Govt. Final Consumption Expenditure, GFCF: Gross Fixed Capital Formation.
Source: Calculated from RBI's Database.

Similarly, from the following figure we can analyse the different components of WPI inflation also:

[3] Here, we are considering 2008-09 and 2009-10 as the crisis period.

[4]Given the structure of the Indian economy, where the financial market is not so developed and more impotently there is a presence of a huge unorganised sector for which it is quite impossible to get funds from the non-banking source, it is believed that bank credit is still a prime credit source for the purpose of real investment.

Chart 4: WPI Inflation and its components: 2003-04 to 2018-19



Source: Calculated from RBI's Database.

From Chart 4 we find that as expected the most volatile components are PA and F&P[5]. The movement of F&P has a very strong influence on both WPI-AC and also WPI-MA. The correlation coefficients between WPI-AC and WPI-MA with WPI F&P are 0.87 and 0.74 respectively. From this we can safely assume that WPI inflation in India is mainly supply-driven or cost-push in nature at least for the period of 2003-04 to 2018-19.

We would like to investigate the above mentioned conjecture on the relationship between money, prices and output for the Indian economy over the said period of time in a more rigorous way by using some econometric analysis. So, first in the following section we are presenting a very brief empirical literature available on this topic.

III. Literature Review and Literature Gap

Rangarajan C. and R. R. Arif (1990)'s econometric model of the Indian economy emphasised the interrelationships between money, output and prices. They established the link between the monetary and the fiscal sectors with the stock of money varying endogenously with fiscal deficits and got the empirical results which showed that the price effects of an increase in money supply is stronger than the output effects.

Das R. (2009) carried out a study on this subject through a simultaneous equation model. She found that endogenous money supply in form of bank credit increases in the wake of increase in price level and it also increases planned output of the economy.

Mishra P. K, U. S. Mishra, S. K. Mishra (2010) examined the relationship for India using cointegration test and the vector error correction model. Their results indicated the existence

[5] PA: Primary Articles; F&P: Fuel and Power; MA: Manufactured Products.

of cointegration between variables. The vector error correction model found the existence of long-run bidirectional causality between money supply and output and unidirectional causality from price level to money supply and output. But, in the short-run a bidirectional causality exist between money supply and price level and unidirectional causality existfrom output to price level.

Sharma A., A. Kumar and N. Hatekar (2010) examined the relationship of money, price and output using a bivariate methodology developed by Lemmens*et al* (2008). It concludes that there is an evidence of money-output trade-off in the short -run, but in the long -run, money supply determines prices, not output.

Al-FawwazTorki M. & K. M Al-Sawai'e (2012) has made a study to determine the casual relationship among growth of GDP, money supply and price levels in Jordan using annual data for the period 1976-2010. They used cointegration and error correction model to find this causal relationship and concluded that monetary policy as a way to change the M1does not have any important implications on changing the nominal income and output in Jordan in the short run.

Dada M. A (2014) conducted a study on the relationship between money shocks, price and output behaviour in Nigeria for 1961 to 2011. He used the cointegration test and concluded that money shocks have positive effect on output and price. He also found that the long-run effect of money shocks on price and output is greater than its short-run effect.
Sing C.R. R. Das and J. Baig (2015) has conducted a study to identify the causality, direction and strength of the relationship between money, output and prices using Granger causality and Co-integration test and they got the result that in long run money supply has a positive relation with price but there is no relationship between money supply and output.

Literature Gap

From the above we can find that most of the studies have focused on the long-run effect of money on prices and output using the co-integration technique and to gauge the short run effect used the error correction model. But our study is very much different from the above studies as we have not only tried to estimate the effect of money supply on the prices and output, but also have tried to find out the other important factors that are affecting the prices and output in the Indian economy for the period 2003-2004 to 2019-2020. Also, we have taken a relatively shorter period of time for our study depending on the relevant policy regime. This is because, we believe that as policy regime changes, the relationship among the macro-variables also change significantly. This is particularly true for a country like India where unlike a matured market economy, the overwhelming importance of Govt. sector cannot be ignored.

IV. Methodology and Data

Data

The study uses quarterly data from the official websites of RBI and Federal Reserve Bank of St. Louis. The variables we have taken are: seasonally adjusted GDP and GDP gap, seasonally adjusted GDP deflator, WPI for all commodities, M3, M1, real and nominal interest rate, exchange rate (Rupee/US$), import deflator, crude oil price, global commodity price index, agricultural GDP and agricultural GDP gap, changes in inventory, bank credit to

commercial sector (BCCS), non-food credit (NFC), net real FDI flows and net real External Commercial Borrowing (ECB). The BCCS, NFC, FDI and ECB are transformed in real terms by using the investment deflator defined as the ratio of nominal to real investment. We have used the log values of the variables, except the rate of interest, to fit the variables better in the linear model.

We take GDP gap[6], and changes in inventory to measure the demand pressure.

We have used GDP deflator as another measure of price index as the WPI does not include the prices for services, but it's overwhelming importance in the Indian economy cannot be overlooked.

The import deflator is taken along with exchange rate (of US dollar) to measure the cost of import. It must have an effect on the domestic inflation through the cost-push channel as India imports non-substitutable intermediary goods on a large scale like petroleum, metals etc. We have also taken the crude oil price and global commodity price index as a cost-push factor.

We have taken the data for FDI and ECB to measure the other sources of funds for investment.

Methodology

The first step of our empirical analysis is to check the stationarity (order of integration) as most of the time series data are used to be non-stationary and the problem of spurious regression with non-stationary data is well-known. We have used ADF (Augmented Dickey-Fuller) test and the Phillips-Peron test to identify the order of integration of the variables.

Following this, we have applied the Granger causality test. But we know that Granger causality among two variables cannot be explained as a real cause-effect relationship, it only shows that one variable can support to predict other variables in a better way. Given the two-time series variables X_t and Y_t, X_t is said to Granger cause Y_t, if Y_t can be better predicted applying the past of both X_t and Y_t.

Then for a more rigorous analysis we have used the regression method using Autoregressive Distributed Lag (ARDL) model. In this model the vector of regressors include lagged values of the dependent variable and current and lagged values of one or more explanatory variables as follows:

$y_t = c + \alpha_1 y_{t-1} + \beta_0 x_t + \beta_1 x_{t-1} + u_t$; where y_t and x_t are stationary variables, and u_t is a white noise.

[6] GDP gap is measured using HP filter. The HP (Hodrick-Prescott (1997)) method decomposes a seasonally adjusted time series into a permanent (long-term) and a cyclical (short-term) component.

V. Empirical Analysisand Findings

The following table 2 shows the ADF and PP tests results of the variables for the model with drift and a linear trend.

Table 2: Unit Root Test Results

Variable	ADF Test Statistics		PP Test Statistics	
	Levels	First Differences	Levels	First Differences
LNSGDP	-0.71	-9.83**	-0.88	-74.21*
LNM1	-1.81	12.79*	-7.15	-90.59**
LNM3	-0.59	-12.41*	-1.99	-12.86*
LNWPIAC	-2.81	-8.12**	-14.18	-64.76*
LNWPIMA	-2.73	-8.11*	-14.05	-64.51*
LNEXCHANGE RATE	-2.29	-6.85**	-6.71	-54.14***
LNBCCS	-1.53	-7.12*	-2.09	-56.73*
LNNFC	-2.81	-7.64*	-14.18	-60.12*
LNINTEREST RATE	-2.89	-9.54*	-14.33	-70.85**
LNSGDP DEFLATOR	-4.45	-14.12**	-30.31	-94.72*
LNIMPORT DEFLATOR	-2.99	-4.36*	-3.77	-10.32*
LNINVERTORY GROWTH	-2.09	-8.29*	-1.95	-8.67*
LNCRUDE OIL PRICE	-2.54	-6.11***	-1.31	-6.39***
LNGLOBAL PRICE INDEX	-1.76	-6.11*	-1.38	-5.81*
LNAGRICULTURAL GDP	-1.64	-6.09*	-1.41	-6.11*
LNFOOD CREDIT	-1.94	-5.85*	-1.97	-6.38**
LNAGRI OUTPUT GAP	-2.79	-7.39*	-3.68	-11.12*
OUTPUT GAP	-4.89	-9.19*	-4.75	-9.31*

Note : * ** *** indicates that significant at 1% 5% and 10% level of significance.
Source: Author's calculation.

The reported result in the above table reveals that the hypothesis of a unit root can't be rejected in all variables at levels. However, the hypothesis of a unit root is rejected in first differences for most of the variables at 0.01 level of significant (only exception are exchange rate and oil price) which indicates that variables are integrated of order one, i.e., the variables are I(1).

Now, before going to the regression analysis, we first use the Granger causality test to have an idea of the direction of causality among the prime variables. This is because, theoretically, as money supply can affect output and prices, output and price can also affect the money supply. This becomes more prominent, when as a measure of money supply we use broad moneyor M_3. Because broad money is created through the credit multiplier process from the high-powered money which can be treated as a policy variable.

Thus using the stationary variables, i.e., first difference of the log values of output, prices and money stocks we have tested the following hypothesis for each pair of the variables:

Null: No Granger Causality i.e., *X*- variable is not cause of *Y*-variable.
Alt.: Existence of Granger Causality *i.e., X*-variable is cause of *Y*-variable.

Now, in table 3, we have shown the summary of results obtained in the causality test:

Table 3: Summary of Test for Granger Causality

Sl. No.	Null Hypothesis	Quarterly Data: 2002-03 to 20019-20		
		F- Values	Null hypothesis accepted/rejected	Conclusion
1	LnGDP →LnM_1	7.12**	rejected	YES
2	LnM_1 →LnGDP	7.13**	rejected	YES
3	LnWPIAC →LnM_1	0.91	accepted	NO
4	LnM_1 →LnWPIAC	0.81	,,	NO
5	LnWPIMA →LnM_1	0.73	,,	NO
6	LnM_1 →LnWPIMA	2.53	,,	NO
7.	LnGDP →LnM_3	2.01	,,	NO
8	LnM_3 →LnGDP	1.51	,,	NO
9	LnWPIAC →LnM_3	0.59	,,	NO
10	LnM_3 →LnWPIAC	1.38	,,	NO
11	LnWPIMA →LnM_3	0.19	,,	NO
12	LnM_3 →LnWPIMA	3.95**	rejected	YES

Note 1.: **implies 5% level of significance.
2.: The Akaike Information Criterion (AIC) has been used to calculate the lag order.
Source: Author' Calculation.

Thus, from the above we can say that not only there exists no reverse causality running from output and prices to money stock (M_3)[7], but what we can usually expect that there exists a causality running from money supply to output and prices is also non-existent. Only with the narrow money, there is a bi-directional causality between output and money. Along with it we have found that broad money supply causes WPI inflation for manufacturing products. This can be a good indicator of demand–pull inflation as all the other commodity group of WPI are basically supply determined. But before we draw any conclusion, we should go for more rigorous econometric analysis by taking more relevant variables into consideration.

The following are the results of ARDL model showing the effect of money along with other relevant macro-variables on output and prices:

Our first model uses GDP deflator as an indicator of price level in the economy and then, we have done the same analysis using WPI-AC:

The following table 4 shows the result of our regression analysis where we have taken log value seasonally adjusted GDP Deflator (LNSGDPDFL) as a dependent variable and log value of exchange rate (LNEXRATE), log value of import deflator (LNIMDFL), log value of inventory capital (LNINVEN), log value of M_3 (LNM_3), log value of Oil price (LNOILP), log value of Seasonally adjusted GDP (LNSGDP), log value of global price index (LNGPI), log value of agricultural GDP(LNAGRIGDP), output gap and agricultural output gap (AGRIOUTPUTGAP) as independent variable. We run this ARDL regression with two lags selected on the basis of AIC and SIC method of lag selection.

[7] The feedback from output to the money supply (M_3) through the process of credit creation depends on the rate of financial savings (i.e., on the increase in new deposits in commercial banks due to increase in income). This again depends on the level offinancial inclusion, the state of income distribution, expected real rate of interestetc.

Table 4: Regression Results for GDP Deflator										
		No of regression								
			1	2	3	4	5	6	7	8
Dependent variable	DLNSGDPDFL-1	Coff	0.26	0.25	0.21	0.19	0.18	0.21	0.17	0.21
	DLNSGDPDFL-2	Coff	-0.09	-0.07	-0.11	-0.09	-0.08	-0.15	-0.05	-0.09
Independent Variable	DLNEXRATE	Coff	1.59*	0.63***	0.08**	0.07***	0.08***	0.62***	0.08**	0.06***
	DLNEXRATE-1	Coff	0.05	0.03	0.02	0.02	0.09	0.01	0.01	0.02
	DLNEXRATE-2	Coff	0.05	0.04	0.01	0.03	0.04	0.06***	0.05	0.06
	DLNIMDFL	Coff	0.03	0.03	0.07**	0.03	-0.27	0.04		
	LNIMDFL-1	Coff	-0.06	-0.11	-0.01	-0.02	0.05	-0.01		
	DLNIMDFL-2	Coff	0.03***	0.04***	0.06*	0.05**	-0.03	0.07**		
	DLNINVE	Coff						-0.04		
	DLNINVE-1	Coff						-0.01		
	DLNINVE-2	Coff						0.11		
	$DLNM_3$	Coff	0.049	0.51**	0.03	0.08***	0.08***	0.63	0.09**	0.07**
	$DLNM_3$-1	Coff	0.02	0.06	0.04	0.09	0.08	0.21	0.15	0.07
	$DLNM_3$-2	Coff	0.06	0.06*	0.06	0.06	0.06	0.06	0.06	0.06
	DLNOILP	Coff	0.05*	0.05*	0.05*	0.05*	0.05*	0.05*	0.05*	0.05*
	DLNOILP-1	Coff	0.02*	0.16**	0.16**	0.16**	0.02**	0.02***	0.02**	0.09***
	DLNOILP-2	Coff	0.01	0.02	0.06	0.04	0.04	0.07	0.03	0.08
	DLNSGDP	Coff	-0.21							
	DLNSGDP-1	Coff	0.15							
	DLNSGDP-2	Coff	0.11							
	DLNGPI	Coff	-0.08		-0.74				-0.05	
	DLNGPI-1	Coff	0.09		0.01				-0.03	
	DLNGPI-2	Coff	-0.09		-0.03				0.01	
	DOUTPUTGAP	Coff		-0.05						
	DOUTPUTGAP-1	Coff		0.07						
	DOUTPUTGAP-2	Coff		0.06						
	DAGRIGDP	Coff				-0.29				
	DAGRIGDP-1	Coff				0.04				
	DAGRIGDP-2	Coff				-0.05				
	DAGRIOUTPUTGAP	Coff					0.27			
	DAGRIOUTPUTGAP-1	Coff					-0.01			
	DAGRIOUTPUTGAP-2	Coff					0.06			
	Adj R^2		0.48	0.51	0.49	0.47	0.47	0.51	0.49	0.48
	DW Stat.		2.02	2.14	2.09	2.13	2.12	2.05	2.15	2.15

Note: *, **,*** indicate1% , 5% and 10% level of significance respectively.
Source: Author's calculation.

From the analysis we have found no significant inflation inertia. But current and lagged values of oil price very much influencing the price level. Also the current value of exchange rate is becoming significant in most of the models; the exchange rate of the second previous period became significant only at the 6^{th} model. The current import deflator became significant in the third model but the value of second previous period has a significant influence on current price level in most of the cases.

Current period Money stock is becoming significant (though at 5 or 10 per cent level) in most of the regression but the lagged values are not becoming significant.

In the 7th model we exclude the LNIMDFL and include LNGPI but, it is not becoming significant. Also, neither of the output variables be it GDP or GDP gap or the agricultural output or agricultural output gap or changes in stock (inventory capital) becoming significant in any of the model.

In the table it can be observed that the second regression model gives the highest number of significant independent variables along with Adj. R^2 value of 0.51.

From this analysis we can say that money supply has a role in explaining inflation, but the external factors like oil price, exchange rate, import prices are the most important explanatory variables at least when the price level is measured by the GDP deflator. This is an indication of cost-push type inflation present in India at least during our study period.

Now, the ADRL model for WPI inflation is shown in the following table 5. In this case also we have selected two lags based on AIC and SIC method of lag selection. The explanatory variables remain same with the previous model. In this case along with exchange rate and oil price, the current value of import deflator, global commodity price index is also becoming significant in models like 2, 4 and 7 with the correct sign. Current oil price, along with its lagged value are becoming significant in all of the models indicating its prime importance in explaining WPI inflation. Also, in this case neither of the output variables are becoming significant in any of the model, though along with current value of money supply, its lagged values are becoming significant in most of the models (but only at 10 per cent level of significance):

Table No 5: Regression Results for WPI

		No of regression								
			1	2	3	4	5	6	7	8
Dependent variable	DLNPWIAC-1	Coff	-0.08	-0.09	-0.11	-0.15	-0.19	-0.01	-0.83	0.06
	DLNWPIAC-2	Coff	-0.05	-0.12	-0.18	-0.05	-0.06	0.08	-0.05	-0.07
Independent Variable	DLNEXRATE	Coff	0.21*	0.19**	0.15*	0.18*	0.21*	0.61*	0.23*	0.28**
	DLNEXRATE-1	Coff	0.06	0.08	0.06	0.07	0.09	0.05	0.25	0.08
	DLNEXRATE-2	Coff	-0.01	0.08	0.07	0.05	0.04	-0.09	0.08	0.05
	DLNIMDFL	Coff	0.08***	0.08***	0.06	0.09***	2.88	0.07		
	LNIMDFL-1	Coff	-0.02	-0.03	-0.03	0.08	2.01	-0.02		
	DLNIMDFL-2	Coff	0.15*	0.14	0.15*	0.15*	-1.86	0.15*		
	DLNINVE	Coff	0.06							
	DLNINVE-1	Coff	0.09							
	DLNINVE-2	Coff	0.06							
	$DLNM_3$	Coff	0.09	0.09	0.09	0.11***	0.13***	0.12***	0.15***	.018**
	$DLNM_3$-1	Coff	0.08	0.09	0.08	0.14***	0.16**	0.12***	0.16	0.16
	$DLNM_3$-2	Coff	0.12***	0.12***	0.12***	0.12***	0.12***	0.12***	0.09	0.09
	DLNOILP	Coff	0.15*	0.15*	0.15*	0.09*	0.09*	0.13*	0.15*	0.13*
	DLNOILP-1	Coff	0.07**	0.07**	0.07***	0.07**	0.07**	0.07**	0.05***	0.05***
	DLNOILP-2	Coff	0.01	-0.5	0.06	-0.14	-0.97	-0.04	-0.13	0.08
	DLNSGDP	Coff		0.15						

	DLNSGDP-1	Coff		-0.19						
	DLNSGDP-2	Coff		0.28						
	DLNGPI	Coff		0.23***		-0.31	-0.48		0.22***	
	DLNGPI-1	Coff		-0.02		-0.44	0.45		-0.02	
	DLNGPI-2	Coff		0.05		0.44	-2.76		-0.01	
	DOUTPUTGAP	Coff			0.33					
	DOUTPUTGAP-1	Coff			-0.51					
	DOUTPUTGAP-2	Coff			0.45					
	DAGRIGDP	Coff				2.78				
	DAGRIGDP-1	Coff				2.23				
	DAGRIGDP-2	Coff				2.24				
	DAGRIOUTPUTGAP	Coff					-2.81			
	DAGRIOUTPUTGAP-1	Coff					-1.23			
	DAGRIOUTPUTGAP-2	Coff					2.01			
	Adj R^2		0.73	0.74	0.69	0.68	0.71	0.63	0.68	0.62
	DW Stat.		2.45	2.18	2.17	2.15	2.19	2.43	1.97	1.98

Note: *, **,*** indicate 1% , 5% and 10% level of significance respectively.

Source: Author's calculation.

From table 5 it is clear that the second regression equation is the best one with highest number of significant independent variables and Adj. R^2 value as 0.74.

The regression analysis here confirms the causality test which shows that WPI-MA may be caused by increase in money supply (M_3) but not WPI-AC. This indicates that even though we cannot deny the presence of demand-pull inflation in India, but the basic nature of inflation is cost-push, determined by the external factors thanks to India's import dependency in terms of intermediate and capital goods.

Now, turning to the output, the following is the ARDL model for explaining the short-run dynamics of the GDP:

$$D(LNOUTPUT) = \alpha + \sum_{i=1}^{2} \beta_i D(LNOUTPUT)_{t-i} + \sum_{i=0}^{2} \gamma_i D(LNPRICE)_{t-i} + \sum_{i=0}^{2} \mu_i D(LNMONEYSUPPLY)_{t-i} + \sum_{i=0}^{2} \delta_i D(LNINTERESTRATE)_{t-i} + \sum_{i=0}^{2} \rho_i D(LNNETFDI)_{t-i} + \sum_{i=0}^{2} \sigma_i D(LNNONFOODCREDIT)_{t-i} + \sum_{i=0}^{2} \omega_i D(LNBCCS)_{t-i} + \sum_{i=0}^{2} \theta_i D(LNECB)_{t-i} + \sum_{i=0}^{2} U_{t-i}$$

Table 6 shows the regression results where we have taken seasonally adjusted real GDP as dependent variable, WPI-AC as a measure of price level, real M_3 and real M_1 as alternative

measures of money supply along with other independent variables as mentioned. We have used two lags based on AIC and SIC method of lag selection.

Let us explain the independent variables and their explanatory power one-by-one:

First we can say that the lag of the first-differenced GDP cannot explain its current dynamics. But we found that WPI inflation along with its first lag is becoming significant in most of the regression models, though sometimes at 10% level of significance. It is surprising because already we have found in the regression result of WPI inflation that it is mainly cost-push in nature where a rise in inflation normally expected to be associated with a fall in output if not otherwise compensated. But if the inflation is demand-pull type, then up to a moderate level, it gives impetus to producers to increase their output signifying a buoyant demand condition. Now, looking at the chart 9 we can at most say that inflation over our study period was more or less moderate, with some occasional high in the years like 2008-09, 2010-11, and 2011-12. So, even if there exists cost-push type of inflation, on an average for the overall study period it could not harm the buoyant sentiment of the economy as a whole. Now, to confirm this analysis, we have used the oil price, which is found to be the main driver of inflation in India, instead of WPI-AC in some regressions. In this case also, we have found significant positive coefficient for the current and lagged values of the variable. This result is also surprising as apparently there is no way that a high crude oil price can give a boost to the real economy. We then thought inflation here affecting the GDP growth through the interest rate channel. A high inflation implies lower real rate of interest which may encourage further investment and thus can raise the GDP.

But, the nominal as well as real interest rate is, when included in the regression models along with their lagged values becoming significant with positive sign consistently. It sounds odd for an investment driven economy. But it may be the case, if domestic investment is relatively less interest sensitive and foreign investment shows high interest sensitivity. Given the world rate of interest, a high domestic rate of interest induces FDI inflows as well as encourages for more ECB which increases the real investment and thus GDP.

We can substantiate the above argument by including the real values of FDI inflows and ECB in our regression which shows high positive and significant values of the coefficients along with their lag values in all the models used.

When we include exchange rate as an explanatory variable, then its current value, along with the second lag are becoming significant with expected negative sign, given the import dependence of the Indian economy. This is because with a rise in exchange rate cost of import, investment sentiments etc. all get hurt and thus negatively affects economic growth.

Table 6: Regression Results for GDP

			No of regression							
			1	2	3	4	5	6	7	8
Dependent variable	DLNREALSGDP-1	Coff	0.87	0.61	0.39	0.35	0.27	0.31	0.72	0.49
	DLNREALSGDP-2	Coff	0.07	0.08	0.09	0.08	0.11	0.08	0.07	0.09
Independent variable	DLNWPIIAC	Coff	0.91*	0.78**	0.68***	0.51***				0.23***
	DLNWPIAC-1	Coff	0.45**	0.53**	0.56**	0.59*				0.64***
	DLNWPIAC-2	Coff	0.97	0.58	0.39***	0.38***				0.94
	DLNINTEREST RATE	Coff	0.82**							0.57**
	DLNINTEREST RATE-1	Coff	0.73*							0.52***
	DLNINTEREST RATE-2	Coff	0.91							0.64
	DLNREALINTEREST	Coff		0.18*	0.17*	0.25**	0.39***	0.43*	0.54**	

RATE									
DLNREALINTEREST RATE-1	Coff		0.07**	0.06**	0.07**	0.08*	0.12***	0.13***	
DLNREALINTEREST RATE-2	Coff		0.06	0.08***	0.11*	0.09**	0.12***	0.07***	
$DLNREALM_3$	Coff	-0.18							
$DLNREALM_3$-1	Coff	-0.45							
$DLNREALM_3$-2	Coff	-0.32							
$DLNM_3$-1	Coff		-0.29**	-0.46	-0.61	-0.37			
$DLNM_3$-2	Coff		-0.35	-0.32	-0.22**	-0.27			
$DLNREALM_1$	Coff								-0.25
$DLNREALM_1$-1	Coff								-0.19
$DLNREALM_1$-2	Coff								-0.34
$DLNM_1$-1	Coff						-0.36**	-0.41**	
$DLNM_1$-2	Coff						-0.22	-0.24	
DLNREALBCCS	Coff						0.18*	0.35**	
DLNREALBCCS-1	Coff						0.19**	0.26***	
DLNREALCBCCS-2	Coff						0.15**	0.17***	
DREALFDI	Coff		0.43*						0.38*
DREALFDI-1	Coff		0.51**						0.41***
DREALFDI-2	Coff		0.46**						0.49
DREALECB	Coff		0.18**	0.45**	0.72**	0.89*	0.87**	0.86**	
DREALECB-1	Coff		0.21***	0.34***	0.52**	0.83***	0.67**	0.88**	
DREALECB-2	Coff		0.23***	0.16**	0.49***	0.73**	0.69**	0.79**	
DLNOILP	Coff				0.06*	0.27**	0.28**	0.76**	0.68**
DLNOILP-1	Coff				0.13**	0.25*	0.32**	0.71*	0.89***
DLNOILP-2	Coff				0.12	0.22	0.29	0.71	0.63
DLNEXRATE	Coff				-0.96*	-0.89*	-0.74*	-0.24**	-0.55**
DLNEXRATE-1	Coff				-0.07	-0.06	-0.07	-0.08	-0.16
DLNEXRATE-2	Coff				-0.56*	-0.59*	-0.16*	-0.09**	-0.05**
Adj R^2		0.82	0.83	0.79	0.81	0.87	0.79	0.89	0.73
DW Stat.		2.14	2.15	2.05	2.09	2.38	2.64	2.41	2.17

Note: *, **,*** indicate 1% , 5% and 10% level of significance respectively.
Source: Author's calculation.

Now, for the money supply we have used both, M_1 and M_3 separately as an explanatory variable. Here first we have used both the variables with their current as well as lagged values. But they fail to explain the short-run dynamics of GDP. Then we have only used the lagged values of the variables to avoid any simultaneity problem (though from the causality test we have found that GDP does not cause M_3, but there is a bi-directional causality in case of M1 and GDP only). Here also we do not get any conclusive result for M_3 while for M_1 only the first lag becoming significant, though weakly, in the two models it has been used, consistently with a negative sign. Here also it is hard to explain the negative relationship of the money supply with the output: this is because, money supply may cause a fall in output through fuelling inflation. But here we have already got a result that inflation maintains a positive relationship with the output.

But we would like to note here hat BCCS, a part of money stock which explains the credit creation part of money supply becomes consistently significant in our regression analysis with expected positive sign for both its current and lagged values.

Thus, from the above we can say that India, an investment driven economy as we have already said, availability of credit, whether it is domestic or external, being the main explanatory variable in explaining the output dynamics over our study period.

So, from the overall analysis we can say that money supplies directly do not have much impact on the overall output, but the credit channel is important.

VI. Conclusion and Policy Prescription

The study investigates the causal relationship between money, output and prices along with other relevant variables for the fast quarter of 2002-03 to third quarter of 2017-18 in India. The Autoregressive lag Distributed model (ARDL) and Granger causality test were performed to test the relationship. The empirical finding indicates that the choice of variable is relevant in the understanding of relationship between money, output and prices. From the overall empirical study we got the result that money supply is not directly affecting the price level, but when taken with the other variables, mainly external factors, then money supply shows some influence over the inflationary process. But when we try to find out the relationship between money supply and output then money supply shows no direct influential relationship with the output. But money supply when used as a measure of bank credit shows significant impact, either alone or with the other external sources of credit on output.

Thus, form the above we can make the following comments on the present day monetary policy: as inflation is mainly driven by external factor, monetary authority should give equal importance, if not more on its growth objective. With imperfect monetary transmission in terms of interest rate, monetary authority may not be much successful in boosting investment through the interest rate channel. Rather it should try to find out the ways through which domestic credit creation can be increased which has significant impact on output growth. Also, we should note that RBI should give emphasis in maintaining a stable exchange rate, if prevention of depreciation is not possible due to the flexible exchange rate regime. This is because we have established a significant positive and negative relationship of the exchange rate with price and output respectively and thus preventing depreciation of exchange rate simultaneously fulfilling both the objectives of RBI, price stability along with domestic growth. From this we may also conclude that for the present macro-situation and the complex interrelations of the macro-variables of the Indian economy, the multiple indicator approach may still fit better for policy formulation rather the current inflation-targeting approach of RBI.

References

Al-Fawwaz, T. M., and Al-Sawai, K. M., (2012). Output, Money, and Prices: The Case of Jordan. *International Business Research*, Volume 5(12), pp. 223.

Balakrishnan, P., (1991). Money, Output and Price Level. *Economic and Political Weekly*, Volume 26(24), pp. 1472-1474.

Campbell, J. Y., Lo, A.W., and MacKinlay, A. C., (1997). The Econometrics of Financial Market. *Princeton University Press, William Street, Princeton, New Jersey.*

Das, R., (2009). Endogenous Money, Output and Prices in India. *Munich Personal RePEc Archive*, Working Paper No 14252.

Dada, M. A., (2014). Empirical modelling of money shocks, price and output behaviour in Nigeria (1961 to 2011). *Journal of Economics and International Business Management,* Volume 2(2), pp. 42-49.

Ghosh, C., and Ghosh, A., (2016), Indian Economy-A Macro-theoretic Analysis. *PHI Learning Private Limited, Delhi.*

Hamilton, J. D., (1994). Time Series Analysis. Princeton University Press, *William Street, Princeton, New Jersey.*

Jha, R., (2003). Macroeconomics for Developing Countries. *Second Edition, Routledge Taylor and Francis Group, London and New York.*

Krishnamurty, K., (2002). Macroeconometric Models for India: Past, Present and Prospects. *Economic and Political Weekly*, Volume 37(42), pp. 4295-4308.

Kannan, R., (1989). Monetary Approach to Balance of Payments: A Case Study of India. *Economic and Political Weekly*, Volume 24(12), pp. 627- 636.

Moroney, J. R., (2002). Money Growth, Output Growth, and Inflation: Estimation of a Modern Quantity Theory. *Southern Economic Journal*, Volume 69(2), pp. 398-413.

Mallik, H., (2011). Monetary Policy, Construction Sector Output and Housing Prices in India: An Emerging Economy Perspective. *Applied Econometrics and International Development,* Volume 11(1).

Mishkin, F. S., (1995). Symposium on the Monetary Transmission Mechanism. *Journal of Economic Perspectives*, Volume 9(4), pp. 3–10.

Mihra, P. K., Mishra, U. S. and Mishra, S. K., (2010). Money, Price and Output: A Causality Test for India. *International Research Journal of Finance and Economics*, Issue 53

Owoye, O., (1997). Money and Economic Activity in Developing Countries: Evidence Based on Cointegrationand Causality Tests. *The American Economist*, Volume 41(1), pp. 70-82.

Rangarajan, C., and Arif, R. R., (1990). Money, Output and Prices: A Macro Econometric Model. *Economic and Political Weekly*, Volume 25(16), pp. 837-852.

Renshaw, F. E., (1976). Money, Price and Output. *The Journal of Finance,* Volume 31(3).

Rath, D. P., (1999). Does Money Supply Process in India Follow a Mixed Portfolio: Loan Demand Model?. *Economic and Political Weekly*, Volume 34(3), pp. 139-144.

Sharma, A., Kumar, A. and Hatekar, N., (2010). Causality between Prices, Output and Money in India: An Empirical Investigation in the Frequency Domain. *Canter for Computational Social Sciences, University of Mumbai*, Discussion Paper 3.

Sing, C., Das, R., and Bail, J., (2015). Money, Output and Prices in India. *Indian Institute of Management Bangalore* (IIMB), Working Paper No: 497

Sabade, S., (2014). Is money supply the cause of inflation in India? An alternative postulate to understand inflation. *Procedia - Social and Behavioural* Sciences, Volume 133, pp. 379 – 382.

Tanwar, R., (2014). Nexus between Inflation and Economic Development in India. *International Journal of Humanities and Social Science*, Volume 3(9), pp.63-67.

Tsay, R. S., (2005). Analysis of Financial Time Series. *Second Edition, John Wiley & Sons Inc., Heboken, New Jersey.*