Cause and Effect Relationship between Money Supply and Inflation in India"

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Abstract

Inflation means rising in overall price level in the economy. Inflation is an important economic factor as it is affecting to purchasing power of consumer and to all the economic aspects of the country. Many factors cause the inflation to high or low rate like monetary and fiscal policy, national debt, production level, aggregate demand and aggregate supply etc. Economists argue that primary cause of inflation in any economy is monetary policy i.e money supply policy of that economy.

The present study, "Cause and Effect relationship between Money Supply and Inflation in India" has been undertaker with an objective to examines the cause and effect relationship between money supply and inflation level during the period of January, 2012 to December 2017. M3 as a representative of Money Supply and Consumer Price Index (CPI) as a representative of Inflations have been considered in the present study. Test of Correlation and Granger Causality have also been applied to find the relationship between CPI and M3

The result of the study reveals a growth pattern in both the selected variables; CPI and M3. Also the Log series of both; CPI and M3 are found to be stationary in nature as per Augmented Dickey Fuller (ADF) Test. The test results of correlation detected strong positive relationship between CPI and M3. However, there is no Causal relationship flowing from M3 towards CPI but there is a unidirectional causality flowing from CPI to M3 which resulted into the effect of Inflation on Money supply.

Keywords: CPI, M3, Inflation, Money Supply, India

1. Introduction

1.1 Money Supply

The supply of money means the total stock of money (paper notes, coins and demand deposits of bank) in circulation which is held by the public at any particular point of time. The stock of money held by government and the banking system are not included because they are suppliers or producers of money and

cash balances held by them are not in actual circulation. In short, money supply includes currency held by public and net demand deposits in banks. In India Reserve Bank of India uses four alternative measures of money supply called M_1, M_2, M_3 and M_4. Among these measures M_1 is the most commonly used measure of money supply because its components are regarded most liquid assets. $M_2 = M_1 +$ saving deposits with Post Office Saving Banks, $M_3 = M_2 +$ Net Time-deposits of Banks and $M_4 = M_3 +$ Total deposits with post office organization + money held outside the country.

1.2 Inflation

Consumer Price Index (CPI) is a measure of change in retail prices of goods and services consumed by defined population group in a given area with reference to a base year. Inflation rates in India are usually quoted as changes in the Wholesale Price Index (WPI), for all commodities. Many developing countries use changes in the consumer price index (CPI) as their central measure of inflation. This index is compiled by Central Statistical Organization.

Inflation is defined as a sustained increase in the general level of prices for goods and services in a county, and is measured as an annual percentage change. Under conditions of inflation, the prices of things rise over time. The value of any unit of money is expressed in terms of its purchasing power, which is the amount of real, tangible goods or actual services that money can buy at a moment in time. When inflation goes up, there is a decline in the purchasing power of money. 3% inflation rate is desirable in the developing counties. Present inflation rate is 4.88%[1] in India. Many factors are responsible for inflation like increase in money supply, deficit financing, increase in government expenditure, inadequate industrial and agricultural growth, rise in administered prices, rising import pricing, rising taxes etc.

1.3 Money supply and inflation

If real income were constant and other factors did not affect the demand for money or were constant, then there would be a proportional relationship between the price level and the nominal quantity of money relative to real income. In other words, growth rate of money supply would be equal to the inflation rate.

It has been well documented in economic literature pertaining to India that excessive growth in money supply has been one of the important and prime reason behind the inflationary price spirals experienced in the past. Along with the supply shocks, both due to a setback in agricultural production and upsurge in International prices of oil, monetary expansion was the major contributory factor to higher inflation in India. The monetary expansion or increase in the money stock, in turn, had been the direct consequence of borrowings of the central govt. from the Reserve Bank or deficit financing by the govt. A strong and influential school of thinking has emerged, saying that the factor chiefly, if not exclusively, responsible for

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[1] https://www.statista.com/statistics/271322/inflation-rate-in-india/

the excessive growth in money supply and, thus inflationary price spirals experienced by India, has been the large scale resort to deficit financing by the govt. It is on this background that a strong case was made against the deficit financing which ultimately led to its discontinuation in 1997.

There is general agreement among economists that there is a causal relationship between monetary inflation and price inflation. But there is neither a common view about the exact theoretical mechanisms and relationships, nor about how to accurately measure it. This relationship is also constantly changing, within a larger complex economic system.

Increasing the money supply faster than the growth in real output will cause inflation. The reason is that there is more money chasing the same number of goods. Therefore, the increase in monetary demand causes firms to put up prices. If the money supply increases at the same rate as real output, then prices will stay the same.

The classical theory of inflation, as espoused by the philosopher David Hume and other early thinkers, only considered money growth, which is the increase in the money stock supplied by the government, to be the main cause of inflation, but money growth is a necessary, but not sufficient, condition for inflation. The velocity of money must also be considered, since there can be no inflation unless the money is spent. For instance, if the money supply has expanded, but the people take it home and stuff it in their mattresses, then it will have no effect on inflation. When people receive money, they eventually spend it by giving it to someone else in exchange for a product or service. In turn, the person who received the money will also eventually spend it, and so on.

The monetarist explanation of inflation operates through the Quantity Theory of Money, where M is Money Supply, V is Velocity of Circulation, P is Price level and T is Transactions or Output. As monetarists assume that V and T are determined, in the long run, by real variables, such as the productive capacity of the economy, there is a direct relationship between the growth of the money supply and inflation.

1. Literature Review

Mallik and Chowdhury, (2001) analyzed the short-run and long-run dynamics of the link between inflation and economic growth for four South Asian economies: Bangladesh, India, Pakistan, and Sri Lanka by applying co integration and error correction models by using annual data. The result revealed that, there is positive and statistically significant relationship between inflation and economic growth for all four countries and the sensitivity of growth to changes in inflation rates is lower than that of inflation to changes in growth rates.

Blavy, (2004), the results confirm the close relation between money supply and consumer prices. Short-term found to influence the long run effects and the impulse response found to create shock in the money stock in two or more years consecutively before stabilizing at high level.

Abbas and Husain, (2006) examined the causal relationship between money and income and between money and prices in Pakistan. Their co integration analysis indicates that the existence of long run relationship among money, income and prices. The causal relationship between money and prices indicated a bi-directional causality that money expansion increases price level and inflation in turn increases the money supply in Pakistan.

Gunasinghe, (2007) analyzed the causal relationship between inflation and economic growth in this country using Granger causality. The result reveals that causality runs from inflation to economic growth for the period 1960-2005.

Moriyama (2008) applied both structure vector auto regression and vector error correction model as a single equation to investigate the inflation dynamics in Sudan. Results indicated that money supply expansion and the nominal exchange rate affected inflation in 18-24 month time lag. Structural auto regression used to forecast inflation in Sierra Leone found that the domestic inflation rate was dominated by the rise of oil prices, money supply and nominal exchange rate depreciation.

 Gottschalk et al. (2008), Co integration and error-corrections modeling used to examine the inflation and monetary pass through in Guinea in 1992-2003. **Tang (2008)** found for monetarists inflation is purely a monetary phenomenon. They argued that a sustained increase of aggregate prices in an economy is caused by the excessive rate of expansion of the supply of money. According to this argument the direction of causality should run from money supply to aggregate prices. On the other hand, other school of thought like structuralists' school challenged "inflation is purely a monetary phenomenon" and argued that the excessive money supply is a consequence rather than cause of inflation particularly in developing countries, i.e., the direction of causality runs from inflation to money supply.

In Africa, Chimobi and Uche, (2010) studied the relationship between Output, Money and Inflation in Nigeria by employing Co integration and Granger-causality test analysis. Their findings revealed non-existence of a co integrating vector in the series used. Money supply was found granger cause both output and inflation. The result implies that monetary stability can contribute towards price stability in the Nigerian economy.

Almounsor (2010) explained the underlying determinants of inflation dynamic in Yemen using the structure auto regression model and a vector error correction model as a single equation. The study found that the inflation dynamic in Yemen has been influenced by its own dynamics and changes in the international prices, exchange rate devaluation, domestic demand shock as well as financial innovations.

Alturki et al., (2010) pointed out short- term, long-term dynamics and forecasting inflation using a vector error correction model (VEM) and Autoregressive Moving Average model (ARIMA) in Tajikstan. Different transmission channels through VECM used to evaluate the relative dominance magnitude and speed of the transmission to the equilibrium price level. The excess supply of foreign money found to affect inflation in the short and long term. In addition, dynamic analysis of exchange rate and international inflation found to affect local product price.

Amin, (2011) studied "Quantity Theory of Money and its Applicability" in the case of Bangladesh using Johansen co integration method; the empirical findings indicate the existence of long run co integrating

relationship between money supply and inflation. The Granger causality test, revealed a unidirectional causal relationship running from money supply to inflation which provides evidence in support for quantity theorist's view.

Kesavarajah and Amirthalingam, (2012) examined the nexus between money supply and inflation in Sri Lanka over the period 1978 to 2010. They employed Johanson and Juseliues multivariate cointegration test and Granger causality test to estimate the long run equilibrium relationship among the variables. The result indicates the presence of long run relationship among the variables and the Granger causality test indicates there was a significant causality from money supply to inflation in Sir Lanka.

Shubhada Sabade (2014), finds that the quantity theory of money gives the identity namely MV = PT which is true, but the functional relationship between M and P, that is, P = f(M) doesn't hold in India since it's based on the constancy of V and T. So when inflation happens it need not be attributed to money supply alone. In fact, even if a greater than required money supply has caused it, there is no guarantee that reduced money supply will bring inflation down. On the contrary, it may have other side-effects such as recession.

James Ezekiel Mbongo et. al. (2014), found that the money supply Granger causes inflation. In addition, money supply and inflation exhibit unidirectional with the fact that, the only Granger value of the money supply causes inflation in Tanzania. Money supply and exchange rate affect directly the inflation in the long and short run, it is evident that the instability of the inflation in Tanzania for a long time is caused by excess supply of money and the deterioration of the exchange rate in Tanzania shilling against foreign currency.

Richard Vague (2016), argues that empirical evidence shows increases in money supply has nothing to do with inflation. Monetarist theory, which came to dominate economic thinking in the 1980s and the decades that followed, holds that rapid money supply growth is the cause of inflation. The theory, however, fails an actual test of the available evidence. In our review of 47 countries, generally from 1960 forward, we found that more often than not high inflation does not follow rapid money supply growth, and in contrast to this, high inflation has occurred frequently when it has not been preceded by rapid money supply growth.

Frank Shostak (2017), , agreed on these views in the article *Mises Wire – 5/5/2017* and concluded that the beginning increases in the money supply need not always to be followed by general increases in prices. Prices are determined by both real and monetary factors. Consequently, it can occur that if the real factors are pulling things in an opposite direction to monetary factors, no visible change in prices might take place. In other words, while money growth is buoyant, prices might display low increases.

As Friedman said, a counter-revolution never restores the initial situation. It always produces a similar situation, which is strongly influenced by the intervening revolution and this is true of monetarism. In accordance with this, it is observed in India that the strong monetary tightening measures taken did not result in the original levels of inflation.

2. Research Methodology

3.1 Research Objective: The objective of this study to find the short run cause and effect relationship between Consumer Price Index (CPI) as a representative of Inflation and M3 – representative of Money Supply in India. From the above literature, it is illustrated that Money supply is an important factor in determining the Inflation. The fundamental theory also supports the fact that increase in money supply shall

lead to increase in inflation. **Gunasinghe, (2007), Moriyama (2008), Kesavarajah and Amirthalingam, (2012)**, **James Ezekiel Mbongo et. al. (2014)** revealed that the Money Supply is causing Inflation. Hence the present study also tries to identify a relationship between M3 and CPI.

3.2 Data: The present study encompasses the Year on Year (YOY %) monthly data of Consumer **Price Index (CPI) and Money Supply (M3)** from January 2012 to December 2017. The monthly data have been extracted from the website of indiamacroadvisors.com. The data is further transformed into log series for further smoothening by using the following equation.

$$R_t = \ln(Y_t) - \ln(Y_{t-1}) \qquad \textbf{(1)}$$

The log transformation reduces the wide range of data to a more manageable size and normalizes the data.

3.3 Methodology: Post application of log transformation, the primary analysis tool of **graphical analysis** has been used. Graphical analysis is the first step in a time series analysis to detect stationary properties, if any. Line graph is applied to identify the trends or randomness in the series of CPI and M3. **Descriptive statistics** was followed by graphical analysis, where emphasis has been placed on general statistics of central position like mean and median. It also focuses upon standard deviation, skewness and kurtosis.

Stationarity is an important parameter to be measured in a time series data. The present research is wholly based on a time series data; hence testing stationary of the data is a prime concern for high-end time series analysis. A time series is called a stationary series, if its parameters such as mean, variance, and covariance do not change with time and do not follow any trend.

Augmented Dickey Fuller (ADF) test is one of the very famous types of unit root tests, which presumes that in an autoregressive statistical model of a time series the autoregressive parameter is one. A time series having a unit root in it is a non-stationary series. For both the series of CPI and M3, the ADF test has been applied to check the stationary. ADF consists of a regression of the first difference of the series against the series lagged k times as follows:

$$\Delta Y_t = \alpha + \delta Y_{t-1} + \sum_{i=1}^{p} \beta_i \, \Delta Y_{t-i} + \varepsilon_t \qquad \textbf{(2)}$$

Where the null hypothesis is H0: $\delta = 0$, Log series for CPI and M3 has a unit root. (Series is not stationary) H1: $\delta < 1$: Alternative Hypothesis, Log series for CPI and M3 has an absence of unit root. (Series is stationary)

Correlation has further applied to CPI and M3 to find the level of association between them.

Granger Causality Test has been applied to confirm the existence of relationship between two variables of CPI and M3. This causal relationship between two variables can have 3 forms - (1) Unidirectional causality- if from both variables either variable significantly causes changes in other variable (2) Bilateral causality-is

suggested when the sets of both time series coefficients are statistically significant and different from zero in both the regressions. (3) Independence-is suggested when the sets of both the time series coefficients are statistically insignificant in both the regression. The time series taken under Granger causality test should follow stationarity. The following pairs of regressions were estimated to test the Causality between the alternate pairs of Indian indices with selected emerging and developed indices.

$$Y_t = \sum_{i=1}^{m} \alpha_i\, Y_{t-i} + \sum_{j=1}^{m} \beta_j\, X_{t-j} + \lambda_1 t + \mu_{1t} \qquad \text{(3)}$$

$$X_t = \sum_{i=1}^{m} \gamma_i\, X_{t-i} + \sum_{j=1}^{m} \delta_j\, Y_{t-j} + \lambda_2 t + \mu_{2t} \qquad \text{(4)}$$

Where m is a suitably chosen positive integer; α_i, β_j, γ_i and δ_j = 0, 1… k are parameters, t is the time or trend variable and it is assumed that μ_{1t} and μ_{2t} are uncorrelated disturbance terms with zero means and finite variances.

## 4 Analyses of Data

4.1: Descriptive Statistics

Table 1: Descriptive Statistics of Log values of Consumer Price Index and M3

Particulars	LOG_Consumer Price Index	LOG_M3
Mean	1.779038	2.404189
Median	1.728109	2.406945
Std. Dev.	0.452117	0.239794
Skewness	-0.511938	-0.991507
Kurtosis	2.875188	3.198191

The above table depicts the results of descriptive statistics of log values of Consumer Price Index as a variable representing Inflation and M3 representing money supply. The Mean and Median values of both the variables are same; 1.77 for CPI and 2.40 for M3. *The Standard deviations of CPI is more (0.45) than M3 which is 0.23 making CPI more volatile as compared to M3.* CPI and M3 are negatively skewed and making the distribution non-symmetric. Kurtosis indicates the extent to which probability is concentrated in the center and especially at the tail of the distribution rather than in the shoulders that are the regions between center and the tails. The Kurtosis for CPI is 2.87 and is found to have Platykurtic distribution as their kurtosis values are less than 3 and M3 has a kurtosis of 3.19 which is mesokurtic which indicates a flat distribution.

4.2 Graphical Representation

Figure 1: Graphical representations of Log values of CPI and M3
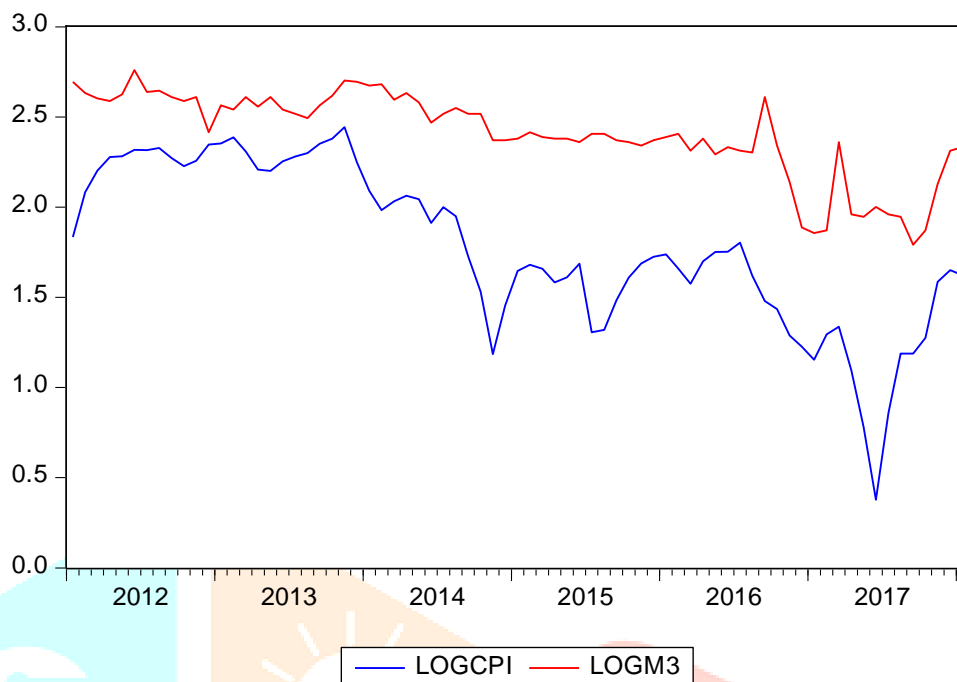
The X axis in above graph represents the year from 2015 to 2017 and Y axis represents Log values of CPI and M3. The graph delineates that both the series appears to move together, however, few minor differences still persists. *The movement of CPI is more volatile as compared to M3 and the same results can also be confirmed with the value of the standard deviations presented in table 1.*

4.3 Unit Root Test

The Augmented Dickey fuller unit root test has been performed to detect the stationary in the log series of CPI and M3

Table 2: Results of Augment Dickey Fuller Test on Log series of CPI and M3

Null Hypothesis: LOGCPI and LOG M3 has a unit root			
Augmented Dickey-Fuller test statistic		t-Statistic	Prob.*
Consumer Price Index (Inflation)		-3.61789	**0.0353**
M3 (Money Supply)		-3.83682	**0.0201***
Test critical values:	1% level	-4.09255	
	5% level	-3.47436	
	10% level	-3.1645	

The above table elucidates the test results for log series of CPI and M3 for ADF test of Unit Root. The null hypothesis for the unit root test ADF is that δ=0, which indicates a presence of unit root in the series (which means the time series is non stationary). The alternative hypothesis is that δ<o, which indicates the absence of unit root in the series and the time series is stationary.

The log series of CPI and M3; both fail to accept the null hypothesis, as the P values of 0.03 and 0.02 are much lesser than the significance value of 0.05 at 95% confidence level and thus making both the series stationary one.

4.4 Correlation

Table 3: Results of Correlation between CPI and M3

Variable	Log_CPI	Log_M3
Log_CPI	1	
Log_M3	**0.821545**	1

The above result reveals a very strong positive correlation between CPI and M3 and hence depicting a strong association between them.

4.5 Granger Causality Test

The Granger Causality test is applied on the series of CPI and M3 as a representative of Inflation and Money Supply. It examines a two way cause and effect relationship flowing between CPI and M3

Table 4: Results of Granger Causality Test between CPI and M3

Pairwise Granger Causality Tests			
Null Hypothesis	**F-Statistic**	**Prob.**	**Results**
LOGM3 does not Granger Cause LOGCPI	**0.0107**	**0.9179**	**Accept**
LOGCPI does not Granger Cause LOGM3	19.0353	0.00004*	Reject

The result of above table reveals that there is no causality flowing from M3 to CPI (0.91) and hence is in significant at 95% confidence level. However, there is a *unidirectional causality flowing form CPI to M3 even at 91% confidence level as the p value of 0.00004 is significant at 1%.* The results hence conclude that there is a short run causal relationship flowing from CPI to M3. But the result does not support the literature of Causality flowing from Money supply to Inflation.

5. Findings and Conclusion

The monthly data from the year 2012 to 2017 has been considered for CPI and M3m which are further converted into log series in order to avoid spuriousness in data. The graphical analysis illustrated not very clear idea for the relationship between CPI and M3 as increasing money supply is not resulting into the increase in the level of inflation. Both CPI and M3 at their log orders are found to be stationary in nature as per ADF test. Also there lies a strong positive correlation between CPI and M3.

But it is demonstrated from the results of Granger Causality test, that CPI (Inflation) in India is not attributable to an increase in Money Supply (M3). Although there is a strong positive correlation detected between CPI and M3, there is no causal relationship flowing from M3 to CPI and hence making it insignificant to determine Inflation using Money Supply. Theoretically, money supply, when is growing faster than the real output will cause inflation in a normal situation. But this correlation may not exist always because of the fall in the velocity of circulation. Also the results revealed in the literature are found to be for the long term impact of Money Supply on Inflation considering Growth. Therefore, the results may differ when the relationship is established for the long period of time. In a short run, this relationship may break down and deviate from the results of the impact of M3 on CPI.

The present study, hence, can be taken forward to analyze the relationship between M3 and CPI with longer data and also considering Growth rate of India.

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