

## **AN ANALYSIS OF RELATIONSHIP BETWEEN MONEY SUPPLY AND GROWTH CYCLES: THE CASE OF INDIAN ECONOMY\***

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### **Abstract**

The present study is an attempt to examine the cyclical relationship between money supply and growth cycles in the Indian economy. Various theorists like Hawtrey, Cassel, Hayek and Wicksell etc. consider monetary factors responsible for cyclical fluctuations. In this paper, Non agricultural GDP is used as a reference variable to represent the cycles in output and M1 is used as a specific variable to represent cyclical changes in the money supply. Bry-Boschan dating algorithm, cross correlation and Granger causality test is used to identify the cyclical fluctuations and lead lag relationship between growth cycles and money supply. It has been identified that money supply is a significant leading indicator of growth cycles in Indian economy.

Key words: Money Supply, Growth Cycles, Cyclical fluctuations, Leading Indicators.

### **Introduction**

Inevitably, market-oriented economies experience cyclical fluctuations in their economic activity and divergence from the equilibrium growth path. Understanding the nature of cyclical oscillations in an economy, economic indicators are essential for forecasting changes in that economy. A business cycle analysis provides insight into the changing pattern of a nation's economic indicators and depicts a picture of the alterations that occur in an economy. It is an effective instrument that makes it easier to comprehend what is happening in the economies all over the world and shows if a system of economics is sound or not. Economic structure is recognized as being economically sound if the business cycle exhibits growth and development, but if there is a decrease, it would be viewed as a failure. The government also looks to the business cycle as one of the factors in basing its economic policies (monetary and fiscal policy) and also to review the effect of its ongoing economic policies on the growth and development of the country. The focus of the policy makers is to forecast the extent of these deviations so that appropriate policy measures can be taken on time. The monetary and fiscal policies are the significant tools of stabilization policy.

Keynes (1936) has defined a business cycle as alternating periods of good trade characterized by rising prices and low unemployment percentages periods of bad trade characterized by falling prices and high unemployment rate. Jan Tinbergen (1947) recognized the cyclical fluctuations as interplay between the erratic shocks and an ability of economic system to make cyclical adjustment movement to such shocks. However, the national bureau of economic research which has been associated with the business cycle studies has adopted the definition given by Wesley C. Mitchell and Arthur F. Burns in 1946. They have defined and characterized the business cycles as “Business cycles are a type of fluctuation found in the aggregate economic activity of nations that organize their work mainly in business enterprises: a cycle consists of expansions occurring at about the same time in many economic activities, followed by similarly general recessions, contractions and revivals which merge into the expansion phase of the next cycle; this sequence of changes is recurrent but not periodic; in duration business cycles vary from more than one year to ten or twelve years; they are not divisible into shorter cycles of similar character with amplitudes approximating their own.”

According to the advocates of monetary theory, monetary factors are one of the major causes and the only cause according to some, responsible for generating cyclical fluctuations in the economy. Therefore, monetary policy can be used as a significant tool to stabilize oscillations in the economy. It has been observed that “over the three decades before 2007 monetary policy emerged as the major tool of stabilization policy” (Gordon, 2012, p.448).

Hawtrey (1928) in his Monetary Theory stated that trade cycle is purely a monetary phenomenon because general demand is itself a monetary phenomenon. He stated that change in the flow of money is the only and sufficient cause of changes in economic activities. The expansionary phase of the business cycles starts when banks increase credit facilities. It comes to an end when banks stop credit expansion and subsequently economy enters in the state of credit deadlock. Recovery will become a very slow and halting process. But according to Hawtrey, the continuous process of cheap monetary policy will eventually start a self-reinforcing process of expansion. R E Lucas Jr. in his paper ‘An Equilibrium Model of the Business Cycle’ has explained monetary shocks as the main cause of cyclical fluctuations. Lucas in his papers (1972 and 1975) has developed an equilibrium approach to analyse the aggregate fluctuations. According to Lucas unanticipated aggregate demand shocks results mainly from unanticipated changes in money supply (Snowden and Vane, 2005). These shocks affect the whole economy by causing errors in rationally formed price expectations and result

in output and employment deviating from their long run equilibrium levels (natural level). This implies that monetary shocks are likely to have a much bigger impact on real variables in countries where price stability is very high. In countries where agents are used to inflation, monetary shocks are unlikely to have any significant impact on real variables.

### **Review of Literature**

The review of literature brings out that there are many theoretical and statistical studies on business cycles. Theoretical studies explain one or the other factor responsible for the emergence of cyclical fluctuations. Basically, the available theoretical frame work focuses on the causes of fluctuation and how it spreads in the other sectors of the economy. The problem of business cycles has been touched upon by classical economists not as a central issue but as a secondary interest and they have given it a passing reference.

**JCL Sismonde de Sismonde, Rodertus and karl Marx** were among the first few economists who gave importance to the fact that economic activities are subject to cyclical fluctuations and they made an attempt to explain these fluctuations. According to **Samuel Jones Loyed, Pigou, Mill and Keynes** it is the business expectations of the people which are responsible for the business cycles in the economy. Many economists like **Herschel, Jevons** etc. were of the view that natural factors are the main cause behind the cyclical fluctuations. There were economists like **Knut Wicksell, Hawtrey, Hayek, Cassel** and **Lucas** who advocated that the monetary factors cause the fluctuations in the economic activities. **Tugan-Baranovski** stated that it is the changes in the aggregate savings as compared to investment which results into the fluctuations in the economy. **J.A Hobson** also concluded that cyclical changes are due to over-saving in the economy. **Kaldor** also in his theory assumed that the process of changes in the economic activity is related to the difference between ex-ante saving and investment.

Some of the economists were of the view that business cycles occurs in the economy due to real factors. **Nelson, Plosser and Kyland and Prescott** from their studies concluded that the business fluctuation in the economy is the result of changes in the real factors rather than in the nominal factors.

A political factor has also been considered as main cause of cyclical fluctuations by some of the economists. **M. Kalecki** and **A. Downs** were the first ones to introduced political factor as a cause of business cycles but the first complete theoretical analysis was given by

**Nordhaus** in 1975. **Samulson** and **Hicks** has given Multiplier- Accelerator model explaining how due to the working of multiplier and accelerator cyclical fluctuations generate in the economy.

There are statistical studies also which have analyzed business cycles statistically without any theoretical base. These studies analyze length, nature characteristics and stylized facts of business cycles and their phases. Major work on statistical analysis of business cycles was by **Burn and Mitchell**. They have given the statistical definition of business cycles in their study. **Geoffrey H. Moore** developed the composite method of leading indicators. But all these studies were related to developed countries.

Lots of empirical work exists on developed economies on business cycles but, same is not the case with developing countries. The research on business cycles in developing countries is comparatively new and the studies which exist on developing countries show that business cycles in developed countries differ from business cycles in developing countries.

**Agénor, McDermott and Prasad** have examined the twelve developing countries and found that their business cycles are highly volatile in nature. According to **Rand and Trap** the length of business cycles in developing countries is shorter and more volatile than those of industrialized countries. **Cashin** in his study found that economic activities in developed countries have positive effects on the business cycles of developing countries. According to **Neumeyer and Perri** business cycles in emerging economies are more volatile than in developed countries. Real interest rates are counter cyclical leading indicator in emerging economies. Whereas, in developed economies real interest rates are acyclical and lagging indicator. **Du Plessis** and **Male** in their studied found that there is little evidence of similarity between the business cycles of the emerging economies and the developed countries. Therefore, same business cycles literature is not applicable on developing countries.

There are studies available on the business cycles in Indian economy. **Chitre** has found that Indian economy has passed through five business cycles from 1951 to 1975. He identified 15 indicators of cyclical fluctuations in the Indian economy and later has identified five leading indicators of cyclical fluctuations. **Dua and Banerji** has identified that the average length of business cycles in Indian is six years. **Working group of RBI** has found five leading indicators considering IIP as reference series. **Mohanty, et. al.** found that there were 13 cycles in the Indian economy during 1970 to 2002 and the average duration of contractionary phase was higher than the expansionary phases. **Banerjee** found that credit cycles lead output cycles or

business cycles in the Indian economy in the pre 1980s period, no relationship between the two during 1980s and then output cycles lead credit cycles in post reform period.

**Thus, with this background, this paper is an attempt to study the relationship between money supply and cyclical fluctuations in the economic activity of the Indian economy.**

### **Method and Data used for analysing cyclical relationship between money supply and growth cycles**

Quarterly data on GDP is used as a reference series to represent the fluctuations in the economy and the series of M1 with the quarterly frequency is taken as a specific series to be used as an indicator of money supply. Data on GDP and money supply is taken from the handbook of statistics on Indian economy published by Reserve Bank of India. Duration of the data is from first quarter of 1996-97 to last quarter of 2021-22.

The data on annual basis, “presents great handicaps for the derivation of useful cyclical measures. Some cycles may entirely disappear, leads and lags may be obscured, durations distorted, amplitude averaged out and cyclical patterns oversimplified. Nevertheless, annual data can show cycles which may lend themselves to analysis” (Bry and Boschan, 1971, p. 117). Again, monthly data would also not be appropriate for analysing lead lag relationship as it will give more noise and varying lag length (Report of Working Group on Economic Indicators, RBI, 2002). Hence, quarterly data is more appropriate for the study of business cycles. Even, data on GDP in India is available on quarterly basis.

For estimating the growth cycles, seasonality and presence of unit root in the log transformed series is checked and adjusted by using X-12 ARIMA method, developed by US census bureau. Later, the extraction of cyclical component from the deseasonalised series is done by using Hodrick-Prescott [HP] filter. For estimating turning points in the output and money supply series, Bry-Boschan dating algorithm known as BB procedure modified by Harding and Pagan for quarterly series known as BBQ procedure is used.

The broad division of cycles is done in two phases, expansion (trough to peak) and contraction (peak to trough). Following Harding and Pagan (2001) the minimum duration for a single phase was set at 2 quarters and the minimum duration for a complete cycle at 5 quarters. The Bry-Boschan algorithm therefore identifies turning points according to the requirements in equation, subject to the censoring rules given by Bry and Boschan (Bry and Boschan, 1971, p.21, Table 1).

**Peak at t if,  $\{(Z_{t-2}, Z_{t-1}) < Z_t > (Z_{t+1}, Z_{t+2})\}$**

**Trough at t if  $\{(Z_{t-2}, Z_{t-1}) > Z_t < (Z_{t+1}, Z_{t+2})\}$**

Where  $Z_t$  is the time series.

The method of Cross-Correlation and Granger Causality Test is used for the identification lead, lag or coincident relationship between money supply and output cycles.

**Growth cycle Chronology for reference and specific indicator series.**

The table 1 and figure 1 shows the growth cycle chronology in the reference series of non-agricultural GDP. The table reveals that Indian economy has experienced four complete cycles during 1996Q1 to 2022Q1. The duration of cycles varies from 8 quarters (24 months) to 35 Quarters (105 months). Average duration of growth cycles is 20.25 Quarters (60.75 months). There are 5 phases of expansion and contraction during the selected time period. The duration of expansionary phases varies from 21 quarters (63 months) to 2 quarters (6 months) with the average period of 9.2 quarters (27.6 months) whereas, the duration of contractionary phases ranged from 3 to 14 quarters (9 to 42 months) with the average duration of 9 quarters (27 months). On an average the expansionary phases lasts little longer than the recessionary phases. Recession for the longest duration during the selected time period was 1997Q4 to 2001Q2 probably due to global recession.

**Table 1: Growth cycle Chronology for reference series (non-agricultural GDP)(period in quarters)**

No.	Peaks	Troughs	Duration contraction (Peak to Trough)	Duration Expansion (Trough to Peak)	Cycle duration
1	NA	1997Q2	NA	2	-
2	1997Q4	2001Q2	14	21	35
3	2006Q3	2008Q4	9	9	18
4	2011Q1	2013Q4	11	9	20
5	2016Q1	2016Q4	3	5	8
6	2018Q1	2020Q1	8	NA	-
	Average Duration		9	9.2	20.25

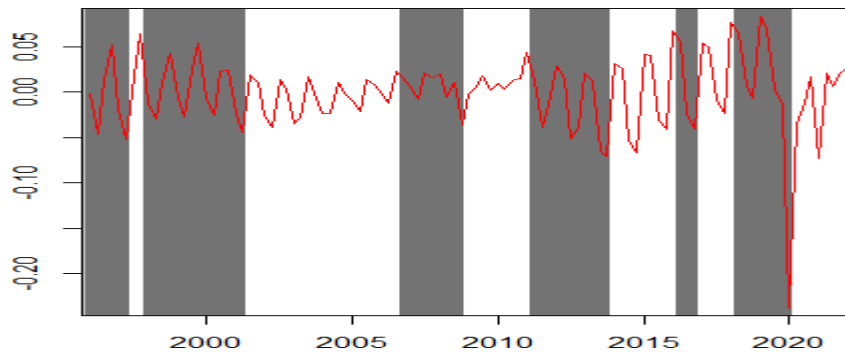


Table 2 and figure 2 reveals the growth cycle chronology of money supply shown through M1 series. Expansion and contraction in this indicator reflect the contractionary and expansionary policy of the monetary authority as well as of commercial banks. Average duration of expansion in the money supply were 8.6 quarters (25.8 months) and of contraction was 6.2 quarters (18.6 months) during the selected time period. The amplitude of contraction in money supply after second quarter of 2016-17 is quite high due to demonetization in the third quarter of 2016-17.

**Table 2: Growth cycle Chronology for indicator series (M1) (period in quarters)**

No.	Peaks	Troughs	Duration contraction (Peak to Trough)	Duration Expansion (Trough to Peak)	Cycle duration
1	NA	1996Q3	NA	2	-
2	1997Q1	1997Q4	3	7	10
3	1999Q3	2003Q2	15	18	33
4	2007Q4	2008Q3	3	8	11
5	2010Q3	2013Q2	11	12	23
6	2016Q2	2016Q4	2	8	10
7	2018Q4	2019Q3	3	5	8
8	2020Q4	NA	NA	NA	-
Average Duration			6.2	8.6	20.25

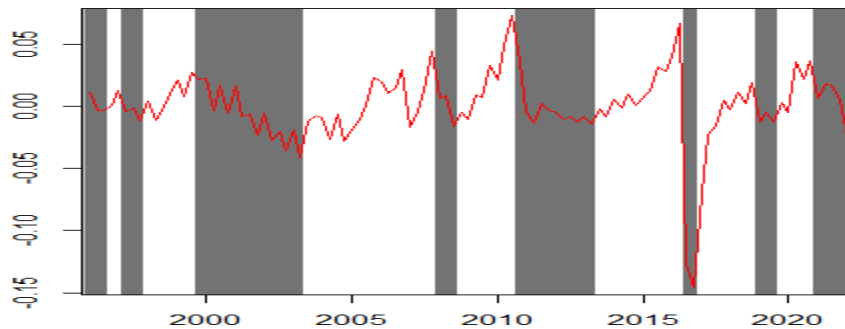
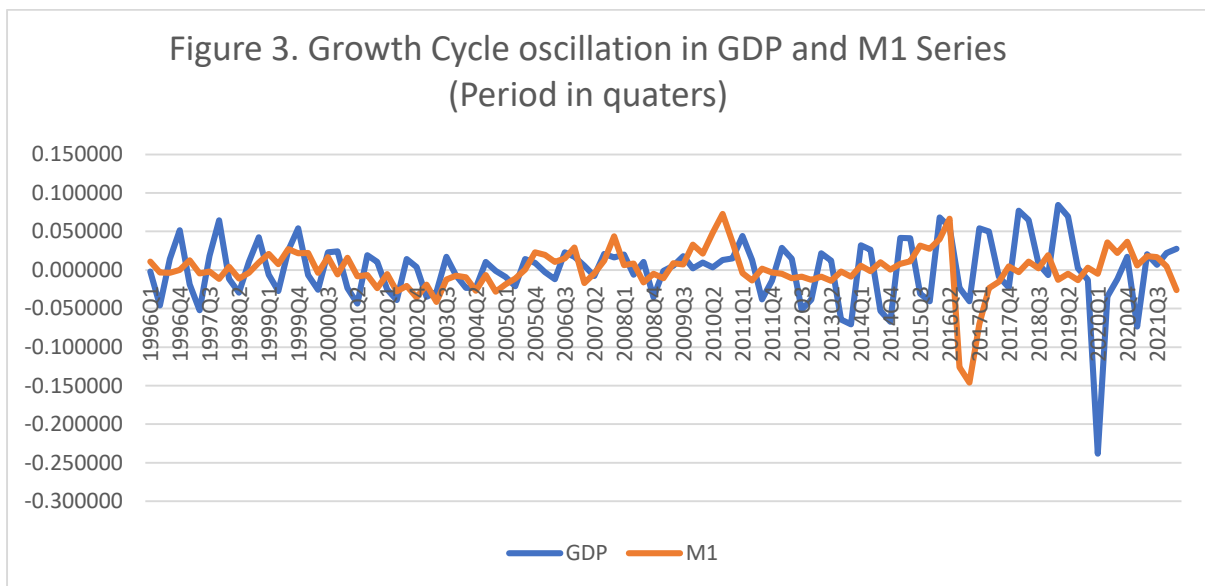


Figure 3 shows the growth cycle oscillations in output and money supply both and it can be seen that oscillation in the GDP is higher than the that in money supply. Calculation of standard deviation of the series of M1 and GDP shows that output is more volatile in nature than money supply as money supply is more of a controlled variable.



**Lead- Lag relationship between reference and specific indicator series:**

For examining lead-lag relationship the Cross Correlation Function and Granger Causality Test have been used. The Cross Correlation Function and Granger Causality Test have been applied on the cyclical components of the series which is a stationary component of the series. Table 3 shows the average duration of leading indicators by which it leads the cyclical fluctuations in GDP and magnitude of cross correlation.



Cross Correlation Function is based on the assumption that there is no cross-correlation between output and money supply. Thus, the null hypothesis is that series are not cross-correlated with each other. But as per the results of cross correlation M1 is cross correlated with the series of GDP and the magnitude of this correlation is 61 percent. Results reveal that oscillations in money supply leads the fluctuations in the output by 1 quarter or three months.

**Table 3 Average Length of Lead of Indicators from Business Cycles (1996Q1-2014Q4)**

Serial No.	Series	Average Lead Duration (Months)	Magnitude Of Cross Correlation
1	Money Supply (M <sub>1</sub> )	3	0.61

**Source: author’s calculation**

To validate the results of cross correlation and to examine the causal relationship between the cyclical component of the series of GDP and M1 Granger causality test is applied. Causality test has been applied on the basis of following Granger Causality Model.

$$\ln(GDP)_t = \alpha_1 + \sum_{i=1}^n \beta_i \ln(M_1)_{t-i} + \sum_{j=1}^m \gamma_j \ln(GDP)_{t-j} + e_{1t}$$

$$\ln(M_1)_t = \alpha_2 + \sum_{i=1}^n \phi_i \ln(M_1)_{t-i} + \sum_{j=1}^m \delta_j \ln(GDP)_{t-j}$$

Table 4 indicates that cyclical fluctuations in GDP do not have significant impact on money supply but cyclical fluctuations in money supply have significant impact on GDP. The p value is significant at 5 % level of significance when the impact of money supply is seen on GDP so the null hypothesis is rejected. The relationship between the two is unidirectional.

<b>Table 4 Granger Causality Test: GDP and Money Supply (M<sub>1</sub>)</b>		
<b>Null Hypothesis:</b>	<b>F-Statistic</b>	<b>Prob.</b>
<b>GDP does not Granger Cause M<sub>1</sub></b>	<b>0.67716</b>	<b>0.7517</b>
<b>M<sub>1</sub> does not Granger Cause GDP</b>	<b>2.14522**</b>	<b>0.0376</b>

Note: \*\* denotes statistical significance at 5% level

**Source: Computed**

Thus, the result in Table 3 and 4 reveals that money supply (M<sub>1</sub>) is a significant leading indicator and has a significant impact on the cyclical fluctuations in GDP. M<sub>1</sub> is a pro cyclical leading indicator. Cyclicity in this indicator indicates greater risk of cyclicity in the output

and plays an important role in the business cycle fluctuations. Therefore, Contraction and expansion in the money supply is responsible to contraction and expansion in the output in the Indian economy.

Thus, Money supply is one of the effective tools in the policy maker's arsenal to avoid contractions in output. Therefore, the policy makers should use money supply in careful manner so that the contractions in the output can be avoided if there is an indication of slowdown in the economic growth.

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