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Money Supply and its Impact on Generating Growth in National Product : Conceptualising a New Macroeconomic Indicator- Acceleration of Money

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ABSTRACT

This research work started with an aim to unveil the concept of a key macroeconomic indicator- velocity of money. Though not widely considered during health check of any economy, this indicator is important in measuring and ascertaining the prevailing broader economic condition. While discussing the concept of velocity of money and elaborating the impact of its effectiveness and fine-tuning on money supply, inflation, monetary policy and overall economic health, one new concept and term has been innovated- acceleration of money. Through cross-country analysis of major economies from developed and developing nations namely USA, India and China, it had been witnessed that acceleration of money, i.e. the change in velocity of money, justifies and conform major global events of economic turmoil. The acceptability of the acceleration term has been reassessed in Indian scenario with quarterly data analysis to find a gap in recent quarters with its previous ones. The acceleration of money term has been separately analysed in Indian scenario where a an autocorrelation has been established and a statistical ARMA(1,1) model has been established at lesser than 1% significant level. This model, without any unit root, may be a useful tool to evaluate the future tendency of acceleration.

Keywords : Velocity of Money, Velocity of Broad Money, Velocity of Currency in Circulation, Acceleration of Money, Money acceleration model, Unit Root testing, ARMA model.

I. INTRODUCTION

Supply of fresh money into the economy of a country is essential for any nation for multifarious reasons. Fresh money pumping may control deflationary trend, increase capital formation, accelerate creative asset building, enhance employment generation with a single-minded objective to contribute to the growth of the country in terms of gross domestic product or national income. As we talk about money supply and its objectives in national growth, we need to have the clarity on the movement of additional currency pumped into the system. Additional money added to the existing stockpile of currency gets multiplied in terms of productivity by generating products or services and changing hands. The more it changes hands, the more it adds to the national product by contributing to its growth with the incremental supply of currency- introducing the concept of velocity of money.

In Physics when we talk about the movement of an element of object and its rate of displacement with time, we call it velocity which is a vector having a directional element attached to it. When we talk about the velocity of money it is simply the speed of money to generate domestic product. The more productivity a unit of money in the economic system generates, the more velocity that money has. To

make it shorter, the more GDP is generated from unit supply of money, more velocity that money possesses, and it is only possible when it changes more hands. We put it in simple equation form as:MV=PT, where velocity of money V= PT/ M and is dependent on general price level of goods, volume of transaction and supply of total money in the system. The same can be calculated in terms of currency in circulation (CIC), Reserve Money (M0), Narrow Money (M1) or Broad Money (M3). In general convention, we calculate velocity of money with Broad Money which includes currency in circulation, term deposits as well as demand deposits encompassing available money in the economy.

We can generalise the concept of money velocity in three different ways namely financial (Fv), industrial (Iv) and income velocity (Mv) of money. Notionally, Fv> Iv > Mv and when we illustrate velocity of money, we generally consider income velocity of money. When the health of an economy is in discussion, the major thrust is on key indicators or parameters namely GDP growth, fiscal deficit, budgetary deficit, inflationary trends, unemployment ratios etc. But velocity of money, though being an indicator of monetary efficiency, lags its importance. When fiscal prudence and discipline is of pivotal importance, efficiency of movement of money should not take a backseat. The aim of all fiscal measures is to curtail deficit and contribute to productive growth. Velocity of money indicates the efficiency of economy and has considerable impact in the growth mechanism.

Velocity is defined in raw term as Money velocity= (Nominal GDP/ Broad Money). The same can be expressed with respect to narrow money or currency in circulation. When broad money is considered as the part of the calculation, it includes time and demand deposits, hence covers the entire gamut of money in the economic system. But what is the desired level of velocity of money value? There is no specified value of the velocity defined that reflects better efficiency or productivity, but its changing nature has considerable implication in the economy.

Previous Research

Many research works have been performed across the globe regarding assessment of money supply, monetary demand-supply balance and its impact on monetary policy. Multiple researches have developed roadmaps and guiding path for future researchers in the field of study of money- demand, supply, velocity and circulation. Barsky, Robert, Alejandro Justiniano, and Leonardo Melosi, in 2014, Dotsey, Michael and Andreas Hornstein, in 2003 and McCallum, Bennett T., in 2001 had justified the importance of money / currency in framing monetary policy. They also mentioned the necessity of monetary demand-supply balance in evaluating interest rate. This was highlighted by Nelson, Edward in 2003. Anderson, Richard G., in 2003, stated its historical evolution evidence for USA.

Bordo, Michael D. and Lars Jonung, in 2005 and Bordo, Michael D., Jonung, Lars, and Pierre L. Siklos, in 1997 researched on velocity of money with its correlation on various policy framework parameters namely interest rate, inflation and gross national product. Cuthbertson, Keith, in 1985, Hamburger, Michael J., in 1966, Friedman, Milton, in 1956 and Judson, Ruth, Bernd Schlusche, and Vivian Wong, in 2014, performed extensive research on demand-supply balance of currency. They pointed out the importance of controlling currency in circulation and also advised policy making authority to maintain due diligence regarding maintenance of desired money velocity. They mentioned the contribution of planned velocity of money on GDP and GNP growth with controlled inflation.

Lucas, Robert E., in 1988, Moore, George, Richard Porter and David Small, in 1990, and Laidler, David E., in 1969, classified the velocity in terms of broad money and narrow money. They stated the acceptability of M2 money in calculating both

circulation and velocity figures. Through multiple quantitative reviews they correctly pointed out the importance of M2 money in balancing monetary demand. Moore, George, Richard Porter and David Small, in 1990, worked out a modeling method for disaggregated demand in the economy that was a trail-blazer in quantitative modeling for monetary demand. Although multifarious researches have been conducted on the stated subject matters, hardly any study specifically talked about the importance of change in velocity of money which has been termed as acceleration in this paper.

II. METHODS AND MATERIAL

Initial Theoretical framework and Methodology

As we get to know the income velocity of money of India, it is understood that generally broad money of India is 8-9 times than the currency available with public. The velocity of broad money got reduced from 2.24 in 1991-92 to 1.22 in 2015-16. But in these 25 years India grew gradually and GDP grew manifold times. Does it imply the reduction in velocity of money? Reduction of money velocity may be due to lesser GDP, more money in the system, more deposit of money, lower price level or lesser transaction volume. GDP grew and price level increased in due course. Hence reduction in velocity may be due to more money in the system or diminishing transactional volume which indicates lesser change in hands and lesser efficiency of money system in India.

Velocity of money is an indicator which is by and large static in nature due to its measurement at a point in time. Its change in value over a period depicts the impact of infusion of currency in the economy. Change in velocity due to change in money supply or money stock implies the impact of unit change in monetary stock to the efficiency of the monetary system. If a unit supply of money increases its velocity, it enhances strength of monetary system as the purpose of infusing that money serve its purpose by increased growth or increased national income or increased transactional volume. How to define this parameter of change in velocity with change in money stock.

The same aspect can be conceptualized with the change in velocity with time in Physics which is termed as acceleration or deceleration. Similarly, this indicator of macro-economic variation has been termed as acceleration of money. It can be represented as Money acceleration over a period = (Change in velocity of money/ change in money stock of Broad Money) = $\partial V/\partial M$. The money acceleration can be represented in terms of both nominal and real GDP as well as of currency in circulation (CIC), Reserve Money (M0), Narrow Money (M1) or Broad Money (M3). For an example, we can represent CIC Nominal acceleration of money = ∂V (nominal GDP) /∂M (CIC).

Acceleration of money covers a duration – monthly, quarter or yearly and the process is dynamic in nature. Velocity of money can't be justified with a desired value whereas the change in velocity with respect to change in money stock identifies positive or negative impact of money change in the velocity of money. When the economy is in acceleration, it means the aim of pumping extra money is fulfilled by generating higher efficiency through higher velocity and vice versa.

Velocity of money = Mv = f(C, I, Gex, M); C= Consumption, I= Investment, Gex= Government Expenditure, M= Money supply;

I, C = f (N, Production, Income Level); N= Population level

Gex = f (N, Income Level);

Change in velocity of money = $\partial V/\partial M$, where for a short period of time (say, quarterly), government expenditure and population level do not change

much. Hence ∂V/∂M reflects change in velocity i.e. change in gross national income combining consumption, savings, investment with respect to change in money supply where acceleration reflects efficient economic progress fulfilling the objective of Government and Central Bank to infuse currency in real terms (overcoming the effect of inflation). Hence, the conclusion can be drawn with rational explanation that pumping additional currency = overcoming inflation effect + creating acceleration. In this research, it has been tried to logically establish the veracity and effectiveness of the newly conceptualized term- acceleration of money.

III. RESULTS AND DISCUSSION

Presentation of data and explanation

The analysis started with the basic presentation of some relevant data pertaining to this research. Various types of Income Velocity data have been represented (Table 1) to understand the initial trajectory of yearly velocity distribution.

Table 1

Year	Income Velocity of Money		
	Gross Domestic Product at Current Market Prices/ Broad Money	Gross Domestic Product at Current Market Prices/ Narrow Money	Gross Domestic Product at Current Market Prices/ Currency with the Public
2015-16	1.22	5.63	9.21
2014-15	1.24	5.77	9.47
2013-14	1.26	5.76	9.44
2012-13	1.26	5.57	9.17
2011-12	1.25	5.36	9.02
2010-11	1.29	5.05	9.15
2009-10	1.25	4.91	9.08
2008-09	1.30	4.94	9.16
2007-08	1.38	5.01	9.64
2006-07	1.46	5.00	9.52
2005-06	1.50	5.15	9.59
2004-05	1.53	5.40	9.63
2003-04	1.53	5.52	9.64
2002-03	1.54	5.69	9.81
2001-02	1.66	5.92	10.37
2000-01	1.63	5.59	9.88
1999-00	1.90	6.26	10.87
1998-99	2.00	6.44	11.34
1997-98	2.09	6.32	11.05
1996-97	2.21	6.39	11.19
1995-96	2.22	6.18	10.94
1994-95	2.18	6.17	11.32
1993-94	2.17	6.35	11.36
1992-93	2.19	6.27	11.68
1991-92	2.24	6.30	11.42

The term acceleration or deceleration as deduced can be verified, identified and deciphered in various economic events across the globe. Figure 1represents M3 Nominal acceleration of money in US economy that contains distinct areas which reflect events of international importance. The first one reflecting high degree of acceleration due to economic boom of post 1990-91 where there was reduction in fed rate along with high degree of employment generation resulting in incremental capital formation. The acceleration part of the curve explains the boom whereas the second marked region highlights the pre and post effect of recession and economic crisis of 2007-09 with its decelerating trend. The recession of 19 months is significantly represented in the plot. The third part depicts recovery trend where the deceleration gets reduced and acceleratory trend is visible. Similarly, when the M2 acceleration with respect to real GDP is plotted (Figure 2), it signifies the trend explained above.

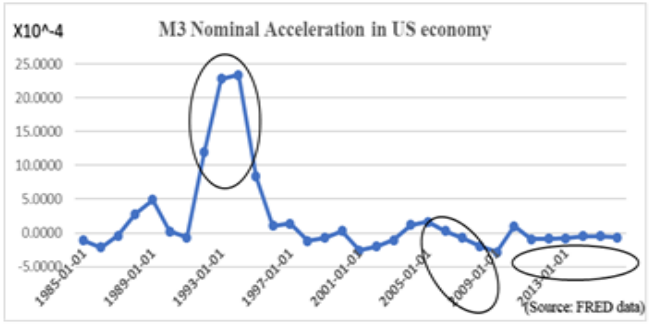

Figure 1

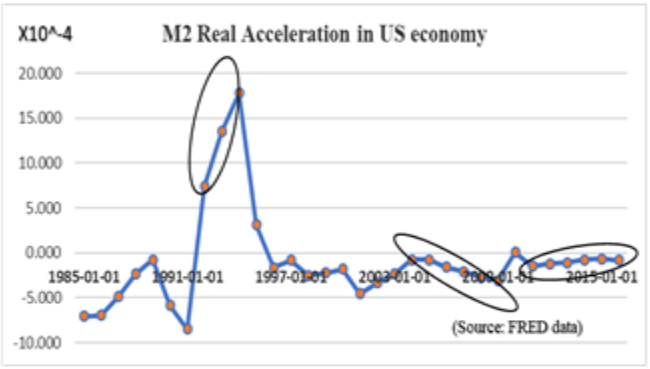

Figure 2

Three areas of special trends highlight the events of economy and acceleration of money can well-explain such behaviors. If the infused money can't compensate the inflationary effect and generate acceleration, the planning in the economy doesn't bear fruit. Hence acceleration is a sign of noticeable impact of planned growth in the economy. Deceleration doesn't only depict slowdown or halt but also exemplifies deviation from planning purpose with efficiency loss because the aim of pumping more money is to increase its movement ensuring transactional multiplication.

The analysis in India's perspectivesignifies an even encouraging picture. Quarterly acceleration of money of India since 1996 has been plotted(Figure 3, Figure 4) for nearly 80 quarters which symbolizes a significant story to prove.

Figure 3

Figure 4

Both the graphs are having similar pattern reflecting gross instability till 2006 and improving stable trend there onwards. The outcome of 30 quarters since April 2009 strengthened the claim of stability in Indian economy (marked in graph 4) when others were struggling with crisis. Although it trickled down to Indian scenario as well, it didn't create a havoc with Indian economy.

The similar analysis was performed subsequently on the much talked about economy of China. China grew at a considerable rate of 7% in 1998 to near 15% in 2007-08 period and still growing at a sub7% level sustainably. The best instance of China's acceleration of both M2 and M3 money is its 3 acceleration points in every 4 quarters (Figure 5, Figure 6) i.e. a sustainable 75%. The continuous acceleration of money in China is an indication of its monetary efficiency. Though the value of acceleration reduced over time, acceleration points in most of the quarters are healthy sign for a developing economy like China. Its M2 velocity of money was same (0.501) in

January 1999 as well as in October 2015 due to its robust growth path and well-tuned system efficiency whereas broad money velocity of India got gradually reduced from 5.36 in 1953-54 to 1.22 in 2015-16. The notable part of China's acceleration plot was its pattern in the graph which signifies its "M" pattern where 3 consecutive acceleration points was followed by one deceleration point and these "M"s are diminishing in size. It enforces stability as well as sustainability whereas acceleration points are prevailing constantly in three quarters out of four.

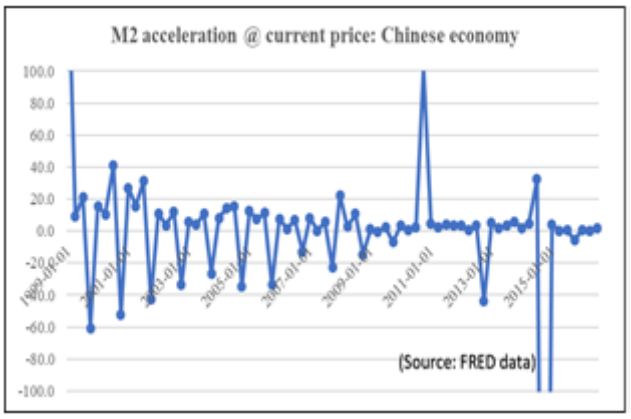

Figure 5

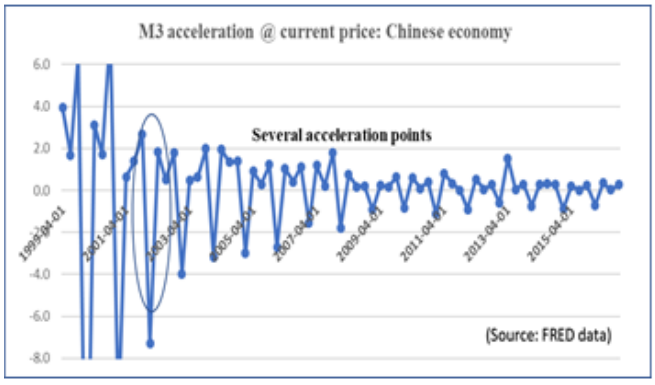

Figure 6

Quarterly acceleration data of 10 quarters up to October 2016 from July 2014 has been analyzed where it represented 4 acceleration points (40%) (Figure 7) which is exemplary compared to its previous 30 quarters (Figure 8). Previous 30 quarters reflect not a single acceleration point which implies the policies undertook might have overcome inflation shocks but could not increase efficiency of money in the economy. January 2007 to January 2009 had many considerable deceleration points that may signify the impact of one of the severest economic crisis post 1930 depression. Furthermore, there was no sign of any acceleration point during recovery time as well.

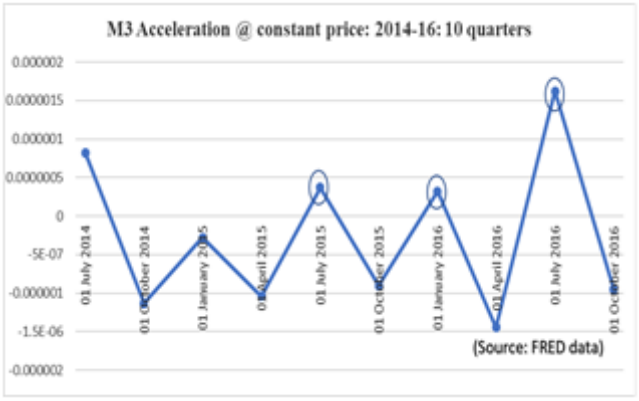

Figure 7

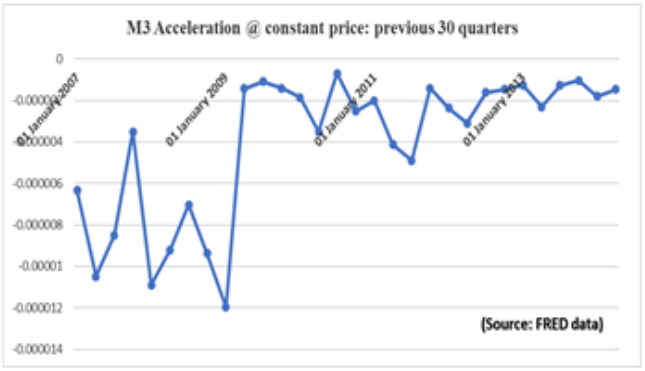

Figure 8

As the importance of the acceleration parameter has been established with multiple cross-country examples and analysis, this research targeted to develop a probable prediction model of acceleration in case of India. The 67 yearly data points since 1950-51 has been utilized to figure out the statistical

Null Hypothesis: AB has a unit root With only Trend
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.191480	0.0000
Test critical values:	1% level	-3.534868	
	5% level	-2.906923	
	10% level	-2.591006	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: AB has a unit root With Trend and Intercept
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.181625	0.0000
Test critical values:	1% level	-4.105534	
	5% level	-3.480463	
	10% level	-3.168039	

*MacKinnon (1996) one-sided p-values.

Figure 9

Dependent Variable: AB
Method: ARMA Maximum Likelihood (OPG - BHHH)
Sample: 2 67
Included observations: 66
Convergence achieved after 45 iterations
Coefficient covariance computed using outer product of gradients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.021488	0.006284	3.419291	0.0011
AR(1)	-0.854354	0.093263	-9.160710	0.0000
MA(1)	0.984104	0.069156	14.23016	0.0000
SIGMASQ	0.002152	0.000352	6.113724	0.0000

R-squared	0.062337	Mean dependent var	0.021600
Adjusted R-squared	0.016966	S.D. dependent var	0.048276
S.E. of regression	0.047864	Akaike info criterion	-3.166939
Sum squared resid	0.142042	Schwarz criterion	-3.034232
Log likelihood	108.5090	Hannan-Quinn criter.	-3.114500
F-statistic	1.373947	Durbin-Watson stat	1.915160
Prob(F-statistic)	0.259055		

Inverted AR Roots	-.85
Inverted MA Roots	-.98

Figure 10

Model for acceleration of broad money (AB) in India. It has been assessed that the series doesn't contain any unit root (Figure 9) and can be modelled with ARMA(1,1) model (Figure 10). Unit root has been tested in with only trend and trend with intercept and in both the cases the test statistics t_{stat}<test critical values resulting in rejection of null hypothesis i.e. there is unit root and acceptance of alternate hypothesis. The ARMA (1,1) model with its significance of coefficients at even 1% level ensures the possibility of modelling the acceleration in terms of Broad Money in Indian scenario as:

$$AB_t = 0.021488 + \varepsilon_t - 0.854354 AB_{t-1} + 0.984104 \varepsilon_{t-1}$$

where the dependent variable consists of its previous value, constant term, residual term and its past value.

Source of Data

The above analysis was based on data available at multiple sources. The monetary statistics data available at Reserve Bank of India web portal was considered for India. The data available at FRED portal (fred.stlouisfed.org) was taken into analysis consideration for US and China. The acceleration was calculated using the change concept.

4.3. Scope and limitations of research

The research work, although caters to the purpose of evaluating the very concept of velocity and unfolding a newer concept of acceleration, has some limitations. The research could have quantified the acceleration with other developed and developing countries to ascertain its effects on the major economic events of the world. The statistical modeling could have been performed for other countries as well for a comparative observation. Similarly the acceleration parameters of developed and developing countries could have been separately correlated to find out their interdependence in various states of economic scenario.

IV.CONCLUSION

Monetary policy is usually the core function of Central Bank of any country whereas Government executes it with developmental policies and available functionaries to achieve growth. I reiterate that to achieve growth with incremental money volume demands high degree of acceleration. The aim of developmental policies is not only to get rid of inflation but also to generate more product and national income that guide the nation towards single aimed growth path. When we talk about 8 % real growth of developing economies, we need to accelerate its monetary pace by gradually incremental velocity with respect to incremental money stock. Number of acceleration points indicate success stories where number of deceleration points reiterate the need to improve upon the efficiency of money stock. For any country, repetitive acceleration points seem theoretical and an uphill task to be implemented but more number of acceleration points somehow emancipate the ability of the policy makers to direct the country to a better growth path.

The newly introduced macroeconomic indicator namely acceleration of money had redefined and reiterated all major economic events, gradual

progress, growth movement, recessionary effect, crisis aftermath, political stability, effectiveness of policy deployment. Many proven facts got revalidated again and most importantly some of the intrinsic indicators or factors got represented in a measurable manner. Acceleration of money mathematically represents change in money velocity with change in money stock whereas it physically symbolizes incremental growth, more transaction or increased productive output. Velocity of money is not considered as one of the key macroeconomic indicators but signifies the efficiency of additional money infused in the system. The static nature of velocity of money can be overcome with the newly introduced indicator which is not only an eye opener but also a remarkable incorporation in the available tools to identify, measure and project growth map of any economy. I will conclude this paper drawing an analogy from Physics where velocity with deceleration may bring a moving object to standstill, similarly velocity of money with deceleration may bring an economy to an unprecedentedly recessionary circumstance. Mathematical models to project acceleration of an economy may open a new area of research with a special emphasis on accelerating global economy for a better, growth driven and well-planned one.

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