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RESEARCH ARTICLE

DYNAMICS OF THE RELATION BETWEEN SUPPLY OF MONEY, CAPITAL FORMATION, INTEREST RATE, INFLATION AND ECONOMIC GROWTH IN INDIA IN THE POST REFORM PERIOD

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ABSTRACT

As is well known the chief objective of any economy revolves around growth of national income. India has been star post 2009 recession among all nations to sustain the pace of economic growth at a fair rate. However the nation faces challenges on many fronts. The synchronisation of the monetary and the fiscal policies play a crucial role in determining the rate and direction of growth. The present paper delves into the possible impact of money supply and other closely related variables like interest rate, inflation rate along with capital formation as a variable.

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INTRODUCTION

Economic growth is one of the main objectives of the government of any nation. Improvement in Gross Domestic Product (GDP) depends on a number of factors. These may both monetary as well as fiscal factors. Different economists give different views about the relative relevance of the fiscal or the monetary policy. As far as the monetary policy is concerned several variables constitute a part of the tools of monetary policy. These may be money supply in the economy, interest rate to mention a few. As per various economic theories it is clear that a fair amount of increase in money supply is warranted with an increase in national income which may not be inflationary. However it remains to be analysed as to whether an increase in money supply is required for growth or not. The present paper examines the case of what has been the impact of an increase or change in the supply of money on economic growth in India in the post liberalisation period. Since money supply is not the only variable affecting the rate of economic growth other variables have also been included in the paper to analyse the relation better. The other variables include Gross Capital formation, interest rate and a measure of inflation. The analysis has been done in the cointegration framework including the Granger Causality test. Money supply refers to the total supply of money in the economy. In case of India there are various measures of money supply in the country namely M1, M2, M3 and M4. Among these M1 and M2 are known as narrow measures of money supply while M3 and M4 are known as broad measures of money supply. The study uses M3 as the measure of money supply. The interest rate affects of the working of the complete macroeconomy of the country as it is a tool at the disposal of the central bank to affect the monetary policy of the country as well as the various lending and deposit rates in the country. This in turn influences the pace of economic activity in the country by influencing the cost of capital in the nation and also the rate of inflation. The Weighted Average Lending Rate (WALR) has been taken as a measure of interest. The rate of inflation is another variable that affects the working of the economy. Here the Wholesale Price Index (WPI) has been taken as a measure of inflation in the country. The paper is divided into three sections, Section I presents the conceptual framework and the literature review associated with the issue. Section II presents the data and methodology used in the study. The results and analysis have been presented in section III.

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Section I

Review of Literature and Conceptual Framework

This section presents the review of literature and the conceptual framework related to the study. This section has been broadly divided into sections. One section deals with literature on economic growth. The next section involves literature associated with impact of money supply on economic growth. Further there is another section involving studies on

inflation and economic growth. And lastly, there is a separate section on impact of capital formation on economic growth.

Economic Growth

The increase in the amount of goods and services produced in the country is considered to be economic growth. Some economists define economic growth as quantitative increase in amount of inputs and output in the country (Johnson, 1987). It has also been defined as long term rise in the productive capacity of the country to supply diverse goods and services (Todaro, 1985).

Impact of Money Supply on Economic Growth

There are studies which reveal that change in supply of money affect the rate of economic growth in the short run (Tobin and Clower, 1970). Some studies suggest the impact on GDP of the interest rate prevailing in the economy. This has been underlined in the case of US economy especially after the recent recession (Lang and Lansing, 2010). It has been found in one of the studies that the effect of changes in money supply on growth is more pronounced than the effect of inflation (Ireland, 1994). It has also been found that the effect of reduction in inflation (Lucas, 2000). Several studies have attempted to test the results of the Quantity Theory Money which states that there is long run relation between money growth and inflation. It has been seen that countries with high money growth (Moroney, 2002). There has also been studies tracing the relation between the growth in money supply as well as change in composition of money supply on long-run equilibrium capital intensity (Stein, 1966). A long run positive relation between money supply and economic growth has been suggested in a study undertaken in the context of Nigeria using a simple regression technique involving a period of nine years from 1995 to 2004 (Isiaka et al., 2011). On the other hand for the period 1986 to 2009 in Nigeria a kind of negative relation between money supply and economic growth has been suggested based on the usual Ordinary Least Squares method (Amassona et al., 2011). Similar result has been obtained in another study conducted again in Nigeria for the period 1970-2008 reveals that there is positive relation between money supply and economic growth (Taiwo, 2012).

Inflation and Economic growth

The impact of inflation on economic growth can be seen from three different angles. There can be no impact of inflation on economic growth. Another possibility is that there is positive impact of inflation on economic growth and the last option is there is negative impact of inflation on economic growth. The first possibility has been highlighted in a study where money is neutral (Sidrauski, 1967). The second possibility has been highlighted in the following studies. In case of Ghana and Nigeria that for a period of 34 years from 1975 to 2008 there has been statistically positive impact of inflation an economic growth. However the causality tests are not strong enough (Christian et al., 2010). Similarly an empirical study based on VAR analysis reveals that there is positive relation between inflation and economic growth but the causality between the two is not established strongly between the two(Osuala, 2013). Similarly again for the Nigerian economy for the period 1973 to 2010 the relation between inflation and economic growth has been similar (Aminu and Amono, 2012). However it has been underlined in a number studies that there may also exist a negative relation between inflation and economic growth. This may be attributed to the depressing affect on investment and productivity (Salian and Gopakumar, 2017).

Impact of Capital Formation on Economic Growth

It has been examined in a study based on secondary data that the growth rate of national income is proportional to capital formation in the economy (Ainabor et al., 2014). Similarly as per atudy based on Nigeria it has been revealed that there is positive relation between capital formation and economic growth (Ugwuegbe and Uruakpa, 2013). The relation between growth, money and inflation in a panel analysis spreading across 160 countries over a period of 30 years suggests that there is a positive relation between the three. However the relation is non-proportional. It is argued that such a result is due to presence of high inflation in the countries in the sample (Grauwe and Polan, 2005). On the other hand another panel study shows a negative relation between inflation and economic growth (Philips and Ghosh, 1998). Similarly a study based on cointegration and Granger Causality analysis tracing the relation between money supply, economic growth and inflation in China suggests that there is no cointegration money supply and inflation as well as there is no relationship between money supply and economic growth (Xie, Tang, Cui, 2009).

Section II

Data and Methodology

The present section throws light on the sources and type of data used in the study and gives an overview of the methodology adopted in the paper. The present paper explores the relation between economic growth, money supply, interest rate and inflation in India in the post liberalisation period. The real Gross Domestic Product (GDP) has been taken as a measure of economic growth. The M3 measure of money supply has been taken as a measure of money supply in the country. The Weighted Average Lending Rate (WALR) has been taken as a measure of interest rate in the economy. The Gross Capital Formation (GCF) has been taken as a measure of investment in the economy. The Wholesale Price Indices (WPI) spliced to a common base have been taken as a measure of inflation. The Time Series data pertaining to GDP, GCF and M3 have been taken from the Reserve Bank of India statistics. The data of WPI has been taken from the Office of the Economic Advisor's website. All the variables have been transformed into real version using appropriate deflator. Further all the variables have been taken in their natural logarithm forms for the purpose of analysis. As a first step the test of stationarity has been conducted using the Augmented Dickey Fuller Test of unit root. In the next step the Johansen's Cointegration Test has been performed. Further the Granger Causality test has been undertaken.

Section III

Result and Analysis

The objective of this section is to explore the dynamics of the relation between economic growth and money supply, investment and the rate of inflation in the Indian economy in post liberalisation period. The period of study is from 1992 to 2011. All the variables have been transformed into their natural logarithms to avoid the problem of heteroscedasticity. Thereafter the stationarity of the variables has been tested using the Augmented Dickey Fuller Unit Root Test. In the next step Johansen's Cointegration Test has been undertaken

followed by Granger Causality Test the results of which are presented below under separate heads.

1.The Stationarity of the Variables

The Augmented Dickey Fuller Test has been applied to test the stationarity of the series of GDP, M3, GCF, WALR and WPI. The model assumes that the natural logarithm of all the variables is a random walk with drift and linear trend. The null hypothesis is that there is a unit root. The results of the Augmented Dickey Fuller Test have been presented in the table 1 below. The results of the test show that the series of GDP, M3, GCF, WALR and WPI are all integrated of order two meaning they are stationary in the second difference form at 10 and 5 percent levels of significance.

Table 1. Test of Stationarity

Variable	Test Equation Type	Order of Integration	ADF Test Statistics
LGDP	Intercept and trend	2	-6.416241
LM3	Intercept and trend	2	-7.654857
LGCF	Intercept and trend	2	-7.938730
LWALR	Intercept and trend	2	-3.645516
LWPI	Intercept and trend	2	-4.561099

Source: Author's own calculation from RBI data.

2.Results of Johansen's Cointegration Test

Since all the variables are integrated of the same order the test of cointegration can be applied on them. Thus, in the next step Johansen's Cointegration Test has been performed to assess if there exists long run relation between GDP, M3, GCF, WALR and WPI. The results of the test as presented below in table 2 show that there are two cointegrating equations among the variables. The probability value (p-value) for at most two and at most three number of hypothesized cointegrating equations is greater than 5 percent. This means that the null hypothesis cannot be rejected. This means that are two cointegrating equation among these variables.

Table 2. Johansen's Cointegration Test

Hypothesized No. of Cointegrating Equations	Eigen Value	Trace Statistics	p-value
None *	0.964553	120.6184	0.0000
At most 1 *	0.787343	60.50326	0.0021
At most 2	0.742420	32.63793	0.0229
At most 3	0.365765	8.222267	0.4419
At most 4	0.001455	0.026210	0.8713

Trace test indicates 3 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
Source: Author's own calculation from RBI data.

3. Results of Granger Causality Test

After tracing the number cointegrating equations it is necessary to check the nature of causality among the variables. The results of the Granger Causality Test thus performed have been summarised below in table 3. Here a lag of two has been taken. The results show that the probability value is less than 5 percent in case of four null hypotheses subjecting them to their rejection. These null hypotheses are namely:

(i) WPI does not Granger Cause GDP,
(ii) GDP does not Granger Cause WPI and
(iii) M3 does not Granger Cause WALR
(iv) M3 does not Granger Cause WPI

This establishes that there is two way causation between GDP and WPI. Changes in M3 cause a change in WALR and M3 measure of money supply affects WPI.

Table 3. Results of Granger Causality Test

Pairwise Granger Causality Tests			
Sample: 1992 -2011			
Lags: 2			
Null Hypothesis:	Obs	F-Statistic	Prob.
M3 does not Granger Cause GDP	18	0.43745	0.6548
GDP does not Granger Cause M3		0.44860	0.6480
WALR does not Granger Cause GDP	18	1.45534	0.2689
GDP does not Granger Cause WALR		1.66823	0.2265
GCF does not Granger Cause GDP	18	3.67624	0.0543
GDP does not Granger Cause GCF		0.02879	0.9717
WPI does not Granger Cause GDP	18	8.95143	0.0036
GDP does not Granger Cause WPI		7.39617	0.0072
WALR does not Granger Cause M3	18	1.39454	0.2827
M3 does not Granger Cause WALR		10.4204	0.0020
GCF does not Granger Cause M3	18	1.99946	0.1749
M3 does not Granger Cause GCF		1.04747	0.3786
WPI does not Granger Cause M3	18	2.26853	0.1429
M3 does not Granger Cause WPI		7.41918	0.0071
GCF does not Granger Cause WALR	18	0.38215	0.6898
WALR does not Granger Cause GCF		1.17409	0.3398
WPI does not Granger Cause WALR	18	0.10921	0.8974
WALR does not Granger Cause WPI		2.79553	0.0978
WPI does not Granger Cause GCF	18	0.95405	0.4106
GCF does not Granger Cause WPI		3.11254	0.0786

4.Economic Interpretation of the Findings

The results of the pair-wise granger causality test suggest that there is two way causation between GDP and WPI. This is quite self-explanatory in nature. An improvement in prices up to a certain level acts as an impetus to encourage production and output. Similarly the second result which says that M3 causes WALR means that a change in money supply leads to a change in the interest rate. This is the usual demand and supply analysis where any change in the supply of money causes a change in its price. The third result that M3 causes WPI is also in concurrence with the theory that an increase in the supply of money in excess of the growth of real output may be inflationary.

Conclusion

Thus the analysis of the relation between GDP, M3, GCF, WALR and WPI based on Granger Causality Test illuminates the theoretical perspective that there does exist causal relation between GDP and WPI which is bidirectional in nature as well as there exists relation between M3 and WALR on one hand and M3 and M3 and WPI on the other hand. All the relations are reflective of the conceptual frameworks developed so far. There is no doubt that an improvement in prices improves production, output and hence GDP. Similarly an increase in money supply shall have an impact on interest rate as well inflation.

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