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TESTING LONG-RUN MONETARISTS' PROPOSITIONS IN SOME INDUSTRIALIZED COUNTRIES

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TESTING LONG-RUN MONETARISTS' PROPOSITIONS IN SOME INDUSTRIALIZED COUNTRIES

N R Bhanumurthy*

Abstract

The present study attempts to test the main monetarists' propositions, which are rather 'always and everywhere controversial'. The study considers three monetarists' propositions, which deals with: the relation between money growth and inflation; money growth and output growth; and output growth and inflation. It considers ten industrialized countries for this purpose. Based on thirty-one years of annual data over the period 1963 to 1993 and using simple correlation coefficients and the Vector Autoregression models, the study found that 'universality of monetarists propositions' proposed by the Chicago school, is rejected, as not all the countries supported it.

1.   Introduction

The relationship between money supply, output and inflation is the main focus of debate both in theoretical and empirical economics since the days of David Hume. The major competing schools of thought that were concerned to explain this relationship can be broadly divided into Monetarist school and non-Monetarist school. The three main propositions of monetarist school that involves money supply, output and inflation are as follows:

1.   Inflation is always and everywhere a monetary phenomenon, in the sense that it is and can be produced only by a more rapid change in the quantity of money. Monetarists are of the view that there exists an exact relationship between changes in money and inflation.

2.   There is no correlation between money growth and real output growth even in the long run, as against the neutrality of money in the short run, advocated by classical economists. (Money super-neutrality proposition).

3.   There is no correlation between real output growth and inflation rate.

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The above three propositions were contested by the non-Monetarist schools, particularly by the Keynesian school, that inflation is not just a monetary phenomenon. They are of the view that any changes in the price level in any economy are just cost-push phenomena, i.e., only through changes in real wages and real interest rates. These theoretical views were empirically tested for in different economies in different situations and in different periods with the help of established econometric techniques. But there is no unanimity in the conclusions about the nexus between money supply – output - inflation, which is very important for policy makers in any economy. In this context, the present study attempts to examine the traditional relationship between money supply – output - inflation in some industrialised countries.

This study is divided into four sections including the present one. In the second section, major studies on the above said propositions are reviewed. The third section presents the scope of the study. database and methodology that are followed. And finally, in the fourth section the estimated results are discussed. Conclusion follows accordingly.

2.   Review of Studies on Monetarist Propositions

The monetarist propositions were extensively tested in the   past. Studies were conducted for many countries by using different methodologies and arrived at different conclusions. While a few studies had refuted the propositions, some supported them. We review some major empirical studies here.

Sims (1972) developed a test of causality between two variables and applied the same on the quarterly data of United States economy for the post - War period. 1949:III to 1968:IV and two of its sub-periods viz., (i) 1949:III to 1957:III and (ii) 1957:IV to 1968:IV.   The variables considered were money supply (both M1 and monetary base) and nominal Gross National Product (GNP). Sims used $(1-0.75L)^{`}$, where L is the lag operator, as filter for achieving stationarity of the data series and carried out Likelihood Ratio test for obtaining white noise residuals. The study estimated the regression coefficient of GNP on both M1 and monetary base with 8 past lags, then M1   and monetary base on GNP with 4 future and 8 past lags. The study concluded that there exists unidirectional causality from money to income. Further, the study concluded that money is found to be exogenous in a regression of GNP on current and past money. There was no change in the conclusions drawn when the sub-periods were considered.

The Sims test was used by Williams, Goodhart and Gowland (1976) for the United Kingdom's quarterly data for the period 1958:I to 1971:III by

using two monetary series M_n (defined as notes and coin plus current accounts with the London clearing banks) and M_b (defined as M_n + deposit accounts with the London clearing banks) which were taken as proxies for narrow (M1) and broad money (M3) respectively, and the Gross Domestic Product (GDP) at current prices. The study used $(1-L)(1-a_1 L-a_2 L^2)$ as filter for attaining white noise residuals.

The conclusion drawn from this study was that neither the causal relationship from money to income nor from income to money was significant. However, the study found that the causation from income to money is marginally significant at 5 per cent level. Based on these results, the study suggested the possibility of a unidirectional causality from income to money for UK. The study also found some evidence of unidirectional causality running from money to price (GDP deflator).

One of the earliest studies using Vector Autoregressions (VAR) for testing monetarists' claim was carried out by Sims (1980). Sims in his 1972 paper, using Granger's causality test, concluded that money stock is exogenous to income for the post-War period using only three variables viz., money supply, industrial production and the wholesale price index. But in his 1980 paper, two separate periods, i.e., post-War period (1948 - 78) and the inter-War period (1920 - 41) were considered. He used the monthly data for the same variables, as in his 1972 paper, in its logarithmic terms with twelve lags of each variable. It was shown that money stock was exogenously determined, and it explained a substantial change in the industrial production in both the periods, more significantly in the inter-War period. Changes in prices were explained by money stock but smaller than what he had found when he used quarterly data rather than monthly data. Since, the industrial production and wholesale price index responded positively to the change in the money stock in both the periods, this model suited the monetarist's framework.

Sims further estimated the VAR system by introducing the short-term interest rates (the rate on 4 to 6 months prime commercial paper) for both the periods and concluded that money stock is no longer exogenous. When the system without interest rate was used for forecasting, innovation in money stock explained 37% of the forecast error variance of industrial production at the forty – eighth-month horizon for the post-War US data. But when interest rate was included in the model, this proportion fell to 4%, which is a non-monetarist explanation for the same data. This study further showed that changes in industrial production and money stock were mostly attributed to common responses to changes in interest rate in the post-War period. And changes in production variance were not due to changes in money stock.

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Hsiao (1981), with the help of an autoregressive model, tried to detect causality between money and income for the US post - War data covering the period from 1947:1 to 1977:IV. The study considered both narrow money (M1) and broad money (M2) as the monetary indicators and nominal GNP as the income variable. To remove the trends in the series, the study used second differenced logarithmic values of all variables. To fix the lag lengths, Hsiao used Final Prediction Error (FPE) criterion and arrived at four lags for M1 and M2, nine lags for nominal GNP and further used Likelihood ratio tests to check the specification. On the basis of the FPE test, Hsiao concluded that there exists a bi-directional causality between M1 and nominal GNP and the unidirectional causation running from M2 and nominal GNP.

Nachane and Nadkarni (1985) tried to test three monetarists' propositions through causality tests. The three propositions were (i) Central Bank actions dominate the movements of the monetary base over time, ii) movements of the monetary base dominate the movements of the money supply over the business cycle and iii) accelerations /decelerations of money supply are clearly followed by accelerations /decelerations in economic activity. They attempted to test the ability of monetary authorities to control the money stock and its impact on the economic activity. This study was based on the quarterly data for the period 1960-61 to 1981-82. Since the quarterly estimates for Gross National Product (GNP) at both current and fixed prices were not available, it used three intrapolative methods to estimate the quarterly estimates for GNP. The three methods are i) Lisman-Sandee method, ii) Minimum squared first difference method and iii) the Minimum squared second difference method. Four major tests based on Granger's causality were used in the study. They are Sims test, McClave- Hsiao test, Cross-Correlation test and the Transfer Function test.

The study concluded that nominal income and the price level influenced the monetary base. In other words, monetary policy in India was not independent. The main monetarists' proposition that money supply causes nominal income and also prices in the long run was proved for Indian data only when M1 (narrow money) was used for money supply. When M3 (broad money) was used, the results were inconclusive. Given the limitations of the intrapolative methods used, these conclusions cannot be taken for granted. The authors rightly said in the paper that the conclusions arrived in the present study are a 'half-hearted vindication of monetarism'.

Dwyer Jr. and Hafer (1988) tried to study the relevance of money with the help of the cross-country analysis for 62 countries for the shorter period i.e., from 1979 to 1984. They used the data of nominal income, real

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income, price level and the money stock (not specified which definition of money they used). The growth rates used by them were the average of annual growth rates for 1979 to 1984 for the long run. For the short-run growth rates, annual growth rates for individual years were considered. The study showed that in the long run, the linkage between growth rate of money supply and inflation was proved to be strong but there exists a loose linkage between the growth rate of money supply, income and prices in the short run.

Holmes and Hutton (1992) brought out a new test called multiple rank - F test for testing causality between money and income. The study considered the seasonally adjusted quarterly income, the adjusted monetary base and the monetary aggregates M1 and M2 of the United States for the period 1970:I to 1988:I. Second differences for all the series were taken to arrive at stationarity in each of the time series based on Dickey - Fuller test. For the specification of the lag structures, the study used five criteria viz., (i) Akaike's Information Criterion (AIC), (ii) Amemiya's Prediction criterion, (iii) Hannan's criterion, (iv) Schwarz's Criterion and (v) Theil's residual variance criterion. The results showed that in the case of the US, causality is from income to M2 and that monetary base was a prima facie cause of income. Further, M1 and M2 were not found to be the cause of income, hence refuting the monetarists' claim.

McCandless Jr. and Weber (1995), with the help of simple correlations, tried to test three monetarists' propositions in the long run. The propositions are (i) High correlation between the rate of growth of the money supply and rate of inflation, (ii) No correlation between the growth rates of money and real output, and iii) No correlation between inflation and real output growth. This was a cross-country analysis for a large number of countries. The study considered 110 countries for a period of 30 years from 1960 to 1990. The variables chosen in this study were M0, M1, and M2 as monetary indicators, Gross Domestic Product adjusted for inflation (real GDP) and the CPI as the price proxy. They calculated the long - run geometric average rate of growth for all the variables and for every country. In the case of real GDP, growth rate is calculated by subtracting the growth rate of CPI from that of nominal GDP.

Two sub - samples i.e., 21 OECD countries and 14 Latin American countries, were examined separately in the study. The study generated evidence in support of the monetarists' claim that it found high correlation (close to one) between growth rate of money supply (for all the money definitions) and the CPI. Another conclusion was that the growth rate of money (for all the money definitions) and the growth rate of real GDP were uncorrelated except for the sub sample of OECD (some positive correlation was found). The

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study also found that the inflation rate and the growth rate of real GDP were uncorrelated.

Most of the studies that are reviewed here are basically done to study the efficiency of new methods by experimenting with monetary theory. Only a few studies like Friedman & Kuttner (1992), McCandless & Weber (1995), Dwyer & Hafer (1988) and Nachane & Nadkarni (1985) were focused purely on monetarist propositions and also on a particular country. Since the propositions are claimed to be universally acceptable, the present study tries to examine the universality of monetarist propositions in a multi-country context by taking ten industrialised economies.

3. Scope, Database and Methodology:

To test the three long - run monetarist propositions, we have taken ten industrialized countries into consideration, which are selected on the basis of availability of good data and reasonably long time series. We considered only industrialized countries in this study as it is established in the literature that the effect of monetary policy will differ from developing to industrialized countries. In the case of developing countries, the monetarists' proposition got little support (Bhanumurthy, 1999). The countries chosen are United States, United Kingdom, Canada, France, Australia, Japan, Germany, Italy, Spain and Belgium. The study makes use of annual data for the period of thirty-one years i.e., from 1963 to 1993, and they are collected from various issues of the IMF's *International Financial Statistics* (IFS). The variables considered are M1 (Narrow money from line 34 of IFS table), M2 (Broad money, sum of line 34 and 35), real GDP and WPI (wholesale price index from line 63). (Since the data are not available at quarterly level for a long period in the case of most of the sample countries and the propositions are claimed to be valid in the long-run, we considered only annual data in this study).

To study the relationship between money, output and prices we have used simple correlations to establish whether the relationship exists or not. And then to see the cause and effect relationship we used the VAR model. VARs are used to analyze the dynamic relationship among variables in the model. It is an atheoretical model where a variable will be regressed on its own past, and past and present values of other variables in the system. The main components of the VAR model are impulse response functions and the variance decompositions. Impulse response functions will explain the responses of all variables in the system due to a one per cent shock in one variable, may be a policy variable. Variance decomposition is one that considers the forecast error variance of all variables in the system that can be explained by innovation in any of the variables in the system. In this study we consider variance

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decompositions to explain the exogeneity of money supply variable in the system. The results are discussed in the next section.

4. Empirical Results: Discussion and Interpretation

As discussed in the previous section, the study estimates simple correlation coefficients between the three variables in question, i.e., growth rate of money supply, real income growth rate and the rate of inflation, for all the ten sample countries. In the case of money supply, the study considers both M1 (money easily used in transactions) and M2 (money easily used in or converted into use for transactions). Real output is estimated by adjusting the GDP at current prices with price index, except for Belgium, where Gross National Product was used to estimate real output.

The study estimated a simple three‑variable VAR model, the variables being money supply growth, real income growth and inflation rate, for all the ten countries.

The VAR model estimated in the present study is as follows:

$$GM_t = a_{10,0} + a_{11,s} \sum_{s=1}^{M} GM_{t-s} + a_{12,s} \sum_{s=1}^{M} GY_{t-s} +$$

$$a_{13,s} \sum_{s=1}^{M} GP_{t-s} + u_{1t} \qquad \ldots\ldots \quad 4.1$$

$$GY_t = a_{20,0} + a_{21,s} \sum_{s=1}^{M} GM_{t-s} + a_{22,s} \sum_{s=1}^{M} GY_{t-s} +$$

$$a_{23,s} \sum_{s=1}^{M} GP_{t-s} + u_{2t} \qquad \ldots\ldots \quad 4.2$$

$$GP_t = a_{30,0} + a_{31,s} \sum_{s=1}^{M} GM_{t-s} + a_{32,s} \sum_{s=1}^{M} GY_{t-s} +$$

$$a_{33,s} \sum_{s=1}^{M} GP_{t-s} + u_{3t} \qquad \ldots\ldots \quad 4.3$$

Where 'M' is the lag length to be fixed in the model, 't' is the time and 'a's are the coefficients to be estimated, and GM, GY, and GP are the log of first

differences of money supply (both M1 and M2), real output and price level respectively. The study considers log first differences because it is established in the literature that almost all the time series data, particularly of macroeconomic variables, are nonstationary in nature. Hence, it is important to ensure stationarity by taking log of first differences of the series. The present study assumes two as lag length for all the countries based on the survey of literature (See Williams, et. al (1976), Sims (1980) and Friedman & Kuttner (1992)).

The ordering chosen for the model is [GM, GY, and GP]. The reason for choosing this order is to find out whether the growth rate of money supply (both M1 and M2) is exogenously determined in the model. This ordering can also be interpreted as that innovations in the present money supply enter the GM, GY, GP equations, the present income innovations enter only the GY and GP equations, and the present inflation innovations are allowed only to enter in the GP equation. With the help of the VAR results we can explain the forecast error variance of all variables in the system which can be explained by shocks in any of the component variables. In this study, 6-period ahead forecast error variances were calculated to determine the exogeneity of the variables. The present study considers only the forecast error variance decompositions (henceforth FEVD) of each country to check whether the money supply variable is exogenously determined in the economy or not. The estimated FEVDs are tabulated for both the definitions of money (M1 and M2) in table-2 and the F-statistics are given in table-3. (In this paper we are not presenting the results of estimated values of equation 4.1 to 4.3, as they are not very useful in the conclusions of VAR system. In the VAR analysis FEVDs and F-statistics are more important than the coefficients of the VAR system).

Empirical Results

We analyze the empirical results of correlation coefficients and the forecast error variance decompositions for each country individually in the following paragraph.

4.1.   Japan :

The estimated correlation coefficients show that there exists a positive correlation between money supply growth (GM) (both M1 and M2) and the inflation rate (GP) (table-1). But the degree of relationship between these two variables is found to be relatively low. In the case of GM and GY, the estimated correlation coefficients show that there is a strong positive correlation (both M1 and M2), i.e., 0.45 and 0.53 respectively. The evidence

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from our results also shows that the growth rates of M2 are slightly more correlated than the growth rates of M1, with GY. And between GY and GP there exists a weak negative correlation i.e., -0.21. The results from VAR indicate that both M1 and M2 are not exogenous as nearly 30 per cent of forecast error variance due to innovations in other variables in the model at six years (for both the money definitions). It was also found from the F-statistics that there exists bi-directional causation between GM and the GY but causation from output to money being stronger (for both the money definitions) which is anti-monetarist in nature. Prices are affected only by its own past values and are not a monetary phenomenon for the money definition M1. But when we used M2, the effect is being positive and significance at five- per cent level.

TABLE - 1

CORRELATION COEFFICIENTS

COUNTRY	M1&GP/ M2&GP	M1&GY/ M2&GY	GY&GP
JAPAN	0.25/0.22	0.45/0.53	-0.21
ITALY	0.01/0.38	0.36/0.04	-0.28
FRANCE	0.36/0.30	- 0.19/0.04	-0.30
UNITED KINGDOM	- 0.017/-0.085	0.21/0.23	-0.43
GERMANY	0.07/0.16	0.06/0.37	-0.03
UNITED STATES	- 0.15/0.09	- 0.09/0.1	-0.43
SPAIN	0.09/0.22	0.34/0.23	-0.31
CANADA	- 0.15/0.37	0.039/0.21	-0.20
BELGIUM	0.47/0.56	- 0.11/0.08	-0.32
AUSTRALIA	0.448/0.46	- 0.14/0.002	-0.42

TABLE - 2

VARIANCE DECOMPOSITIONS

COUNTRY	GM	GP	GY
JAPAN			
GM	72.7/74.4	23.1/24.5	4.2/1.2
GY	28.3/31.5	70.6/64.0	1.1/4.03
GP	39.1/57.2	9.97/12.3	50.9/30.5
ITALY			
GM	54.4/60.9	14.9/14.3	30.7/24.8
GY	7.6/10.4	41.8/39.5	50.6/50.1
GP	8.3/10.3	35.2/31.0	56.5/58.7
FRANCE			
GM	93.6/82.1	4.1/15.5	2.3/2.5
GY	10.9/4.9	77.5/84.1	11.6/11.0
GP	23.4/21.4	42.8/38.4	33.8/40.2
UNITED KINGDOM			
GM	96.6/90.4	1.3/2.6	2.1/7.0
GY	24.9/25.2	72.1/72.2	3.0/2.7
GP	7.9/6.8	24.9/15.2	67.2/78.0
GERMANY			
GM	89.1/98.4	1.9/0.8	8.9/0.9
GY	35.2/27.7	50.8/66.2	14.0/6.0
GP	27.3/21.2	13.7/43.8	59.0/34.9

UNITED STATES

GM	79.7/83.6	9.1/2.2	11.2/14.2
GY	9.6/58.8	70.3/24.1	20.1/17.1
GP	11.6/53.5	42.8/4.4	45.6/42.0

SPAIN

GM	45.4/57.3	12.2/21.0	42.3/21.7
GY	17.4/15.3	57.1/61.0	25.5/23.7
GP	5.1/8.2	18.7/13.4	76.2/78.4

CANADA

GM	72.6/78.1	4.9/3.6	22.5/18.3
GY	16.9/25.3	54.9/50.2	28.3/24.5
GP	19.5/19.1	16.7/13.2	63.8/67.7

BELGIUM

GM	78.1/75.3	17.7/15.0	4.2/9.7
GY	16.3/41.1	67.3/46.8	16.4/12.1
GP	21.6/26.2	7.4/3.8	71.1/70.1

AUSTRALIA

GM	93.6/79.5	1.1 /6.7	5.3/13.9
GY	25.3/10.0	51.4/58.8	23.3/31.1
GP	9.9/13.4	13.8/11.2	76.2/75.4

Note: Entries gives the percentage of the 6-step ahead forecast error variance when GM is calculated from M1/M2 respectively.

TABLE -3

F - STATISTICS

Variable	GM	GY	GP
GERMANY			
GM	0.528 /1.461	1.521 /1.455	0.961 /0.901
GY	0.143 /0.015	0.827 /1.824	1.377 /3.827[2]
GP	1.726 /0.065	0.666 /1.378	33.86[1] /29.31[1]
AUSTRALIA			
GM	1.151 /1.111	2.161 /0.559	0.112 /0.177
GY	0.197 /1.589	3.075 /3.575[2]	4.979[1] /4.521[2]
GP	1.228 /1.728	6.246[1] /7.069[1]	24.712[1] /26.29[1]
BELGIUM			
GM	0.859 /0.876	0.147 /0.876	1.28 /1.574
GY	2.166 /2.454	2.445 /1.422	0.21 /0.445
GP	0.357 /0.579	2.285 /1.828	24.06[1] /23.853[1]
JAPAN			
GM	0.12 /1.89	2.73[3] /5.54[2]	2.42 /4.01[2]
GY	4.01[2] /3.73[2]	2.86[3] /3.26[3]	0.42 /0.41
GP	0.94 /0.53	0.06 /1.09	11.44[1] /13.29[1]
ITALY			
GM	4.431[2] /5.566[2]	0.305 /0.637 -	1.432 /1.606
GY	6.283[1] /5.372[2]	4.734[2] /4.348[2]	0.637 /0.411
GP	4.434[2] /2.728[3]	11.829[1] /11.849[1]	6.070[1] /6.013[1]

Variable	GM	GY	GP
UNITED KINGDOM			
GM	0.302 /0.309	1.472 /0.43	1.443 /0.04
GY	0.012 /0.025	0.315 /0.41	5.79[1] /3.42[3]
GP	0.217 /0.686	0.42 /0.26	21.808[1] /20.0[1]
SPAIN			
GM	0.629 /2.246	0.816 /1.27	0.742 /1.13
GY	0.423 /2.383	0.618 /0.65	0.80 /1.42
GP	4.359[2] /1.521	0.786 /1.40	20.765[1] /22.28[1]
UNITED STATES			
GM	0.009 /1.449	0.042 /8.514[1]	1.226 /0.927
GY	1.654 /1.367	0.812 /0.767	4.508[2] /2.278
GP	2.497 /1.032	4.727[2] /4.468[2]	28.96[1] /19.84[1]
CANADA			
GM	0.374 /5.566[2]	0.704 /0.637	0.789 /1.606
GY	0.041 /5.372[2]	0.525 /4.348[2]	5.841[1] /0.411
GP	3.117[3] /2.728[3]	3.125[3] /11.849[1]	42.38[1] /6.013[1]
FRANCE			
GM	2.712[3] /0.201	0.257 /0.108	3.681[2] /3.164[3]
GY	0.909 /1.643	2.537 /3.179[3]	3.074[3] /2.246
GP	0.568 /1.188	1.499 /1.331	68.89[1] /55.138[1]

Note: Entries gives the F- statistics. GM is calculated from M1/M2 respectively.

'1' denotes that the statistic is significant at 1 % level
'2' denotes that the statistic is significant at 5 % level
'3' denotes that the statistic is significant at 10 % level

4.2.   Italy :

In the case of Italy, the results show that only growth rate of M2 is positively correlated with inflation rate (0.38).   The evidence on the long run relationship between money growth and output growth shows positive correlation between M1 growth and output growth (0.36) but absolutely no relationship between M2 growth and output growth (0.04).   Between GM and GY, there exists a negative correlation , which is not negligible i.e., the correlation between these two variables is 0.28.

The F-statistics shows that money supply is significantly influenced output and prices. There exists uni-directional causation from prices to money, which is anti-monetarism in nature. It was also found that output growth is price inducive (highly significant at five per cent level). The FEVD results show that both M1 and M2 are not exogenously determined as only 55 per cent and 60 per cent of forecast error variance is attributable to innovations in M1   and   M2 respectively in a 6-year period.

4.3.   France :

In the case of France, the results show positive correlation between both the money supply growth rates and the inflation rate. Further, the results show that growth rate of M1 is negatively related with output growth (-0.19), but there is no relationship between M2 growth and output growth. Between growth rate of real output and inflation rate, the results show that there is a negative correlation between them. It was found through F-statistics that inflation is determined by money supply and money supply is exogenously determined in the system.   The FEVD results also reveal that both M1   and M2 are exogenously determined in the country and the forecast error variance being 93 per cent and 82 per cent, for M1 and M2 respectively, is attributable to the innovations in the same variable.

4.4.   United Kingdom :

In the case of UK, the data shows that there is weak negative correlation between the growth rate of money (both M1 and M2) and inflation rate as the correlation coefficients estimated are -0.017 and -0.085. But there is a weak positive correlation between the money growth (both M1 and M2) and output growth. And also a strong negative correlation between output growth and inflation rate is reported. From the F- statistics, it was found that there is no significant causation between money growth and inflation. Both the   money definitions are exogenous as the forecast error variation results show that 96 per cent and 97 per cent of, for M1 and M2 respectively, of variation is attributable to its own.

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4.5. Germany :

The data shows that there is no relation between growth rates of money and the inflation rates (0.07 in the case of M1 and 0.16 in the case of M2). Between money growth and output growth, only M2 shows positive and significant relation (0.37). The data also shows that there does not exist any relation between output growth and inflation rate. The results from F-statistics are consistent with correlation results. Both the money definitions are exogenous as FEVD results shows that more than 88 per cent and 97 per cent of forecast error variance M1 growth and M2 growth respectively, is attributable to own variation.

4.6. United States :

The data shows that in the case of money growth and inflation, there exists a weak negative correlation when M1 is used. When M2 is used the correlation coefficient is almost equal to zero even though positive. Between money growth and output growth, both the money definitions exhibit neutrality. But there exists a strong negative correlation between output growth and inflation rate. The results from F-statistics show that money is exogenously determined in the system and has no causal relationship with inflation. Inflation is a result of its own past values only. It was also found that output is negatively dependent on prices as F-statistic is significant at five per cent level. The variance decompositions results show that both the money supplies are exogenous, as nearly 80 per cent of forecast variation is attributable to innovations in its own variable.

4.7. Spain :

When M1 is used as money supply, the correlation coefficient between M1 growth and inflation is almost zero. But when M2 is used in the place of M1, the results show that there exists a positive relationship. But between both the money definitions and output growth the results show there is positive correlation. The results also show that output growth and inflation are negatively correlated. The F-statistics show that price changes are independent of money and output changes. But price change is found to be cause variable for changes in M1. Variance decomposition results show that both the money supplies are endogenous. As in the case of M1, more than 55 per cent of variation is due to innovations other than M1 and in the case of M2, the results show that nearly 40 per cent of the variation is explained by GY and GP.

4.8. Canada :

The money supply growth is found to be positively correlated with the inflation rate when M2 is used. But when M1 is used the results show that there is negative relation between the two variables. There exists a weak positive correlation between money growth and output growth when M1 is used, and when M2 is used the correlation is positive and stronger. The study also found a negative correlation between output growth and inflation (-0.20). There exists bi-directional causation between inflation and output growth, attributing to the claims of structuralists, and is not dependent on money changes. The FEVD results show that both the money definitions are endogenous as 27 per cent of variation is due to innovations in GY and GP.

4.9. Belgium :

There exists a strong positive correlation between both the money definitions and the inflation rate and the coefficients being 0.47 and 0.56 for M1 and M2 respectively. The results also show that M1 growth and output growth is weak and negatively correlated. But when M2 is used, the relation turned out to be positive (0.08). Between output growth and inflation rate the study finds out a weak negative correlation. The proposition that inflation is a monetarist phenomena is not supported by the F-statistics. It also found that there exists no causation between output growth and inflation and between money growth and the output growth. The FEVD results reveal that only M1 is exogenous as nearly 80 per cent of variation in M1 is due to innovation in M1 itself. But in the case of M2, only 70 per cent of variation are explained due to innovation in M2.

4.10. Australia :

The correlation between money supply growth and inflation is high and positive. This result is consistent for both the money definitions. But the money's relation with output growth is negative and significant when M1 is used and when M2 is used the relation, tends to zero (0.0002). Output growth and inflation are strongly negatively correlated. The F-statistics shows that there exists strong bi-directional causation between output growth and the inflation and the coefficient being negative for both the lags. The variance decompositions show that both M1 and M2 are exogenously determined as more than 93 per cent and 80 per cent of forecast error variation respectively for M1 and M2 are attributable to innovations in the same variables.

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Conclusions :

From the results obtained and as analyzed above, the interrelationship between money growth, real output growth and inflation rate are not consistent across countries and for different definitions of money supply. The findings of this study may be summarized as under:

(1)   The proposition that there exists a strong positive correlation between growth rate of money supply and the inflation rate in the long run has been refuted by the economies like United Kingdom, United States, Germany, Italy, Spain and Canada. Particularly United Kingdom shows negative relation between the two variables. This result is not consistent when we use different money definitions. For example, in the case of Italy, the results show that when M2 is used, the relation is positive and strong. But when M1 is used, the results show that there is no correlation between the variables.

(2)   The second proposition that there is no correlation between money supply growth and output growth was found only in the economies like France, United States, Belgium and Australia for both the money definitions. In the case of Canada, and Germany, this proposition is valid only in the case of M1. Remaining countries refute this proposition. It can also be concluded that money supply in these countries is adjusting for output in the long run. The long run money neutrality as claimed by the monetarists has not been found in most of the sample countries.

(3)   The third proposition that there is no correlation between output growth and inflation holds only in few economies like Germany, and Belgium. The remaining countries show strong negative relation and hence refuting the monetarists' claim of no correlation, either positive or negative, between output growth and inflation in the long run.

From these results, one can easily conclude that the monetarists' claim that 'inflation is always and everywhere a monetary phenomena' and is not valid as very few countries corroborated to this proposition. The rejection of these important monetarists' proposition might lead to possible acceptance of its 'opposite theory'. There is evidence from this study that there exists relation between output growth and the price growth, which is not negligible, in few countries, corroborating to the structuralist view of inflation. Neutrality of money in the long run has also being rejected in some countries. This result clearly concludes that Milton Friedman's claim of validity of monetarists'

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propositions in each and every part of the globe and for a wide diversity of monetary arrangements is rejected. The behaviour of real output and prices and the role of money supply will certainly depend on the monetary arrangements and other conditions in the economy.

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