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Das, Rituparna

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Rituparna Das

Introduction

It was reported by researchers that –

(a) a series of papers started coming up since 1973 on the relationship among money, output and prices in the Indian economy though Bhattacharya (1972) estimated the relationship between money and output in India with the simple OLS technique; till 1982 in India, research works in this area covered unidirectional causations like from money supply to output and from money supply to prices; after Granger (1969) was published, attention of researchers went towards causality between a pair of economic time series among forecasters in studies of the causal effects of one series on the other;, Sims (1972) undertook an exercise based on Granger to detect casual direction between money and income in the post-war data; from the analysis Sims observed that while income did not cause money, money caused income; on the same principle a more detailed study was undertaken by Pierce (1977) to establish the causal relationships between several pairs of variables in the US economy; Pierce observed that numerous economic variables which were generally regarded as strongly interrelated might, with equal validity based on recent empirical evidence, be regarded as independent or weakly related; on the Indian data, Nachane et al (1985) undertook a similar study and found that high powered money caused broad money M_3 for short period, M_3 affected price in long run; Granger's paper on causality (1969) and Sim's further contribution (1972) influenced the researchers on Indian economy; Sims (1972) applied the Granger causality to test for evidence of unidirectional causality between money and nominal income in the U.S. for the period 1947-69; since 1983 papers on causality between money supply and output and between money supply and prices started coming up in India,

(b) Brunner and Meltzer (1964) and Cagan (1965) created of curiosity among the Indian researchers on money multiplier m in the identity M = mR, where M was money supply aggregate, R was reserve money; two issues of particular concern, stability and predictability were crucial determinants of the superiority or otherwise of the monetary base as an instrument of money-stock control vis-à-vis interest rates as per Pierce and et

al (1972) because there developed an extensive literature on money-multiplier forecasting models revolving around these two issues,

(c) Burger et al (1971) envisaged the monetary policy problem facing the US Federal Reserve Board, as one of determining the optimal level of the monetary base for a targeted level of money supply in the face of a stochastically fluctuating money-multiplier; the multiplier was modelled by a regression involving its own lagged values and certain other economic variables; Bomhoff (1977) took a somewhat direct view of the problem and modelled m as a univariate Box-Jenkins ARIMA process; Bomhoff's approach was refined and elaborated in a series of papers by Johannes et al (1979, 1981, 1982) who formulated ARIMA models for the components of m (such as the currency-deposit ratio, bank borrowing ratio, adjusted reserve ratio etc) on the presupposition that the components approach being based on more disaggregated information et al Hein (1984) contradicted this supposition with an empirical demonstration wherein aggregate approach fares as well as the components approach, but fails to offer any analytical explanation of this paradoxical phenomenon;

(d) in India a great debate centring on the money multiplier was seen in the mid during 1976-78; supporters of money multiplier approach like Gupta (1976a, 1976b) and Swamy (1978) challenged the traditional RBI viewpoint on this approach that the latter had little bearing on the operational aspects of monetary policy; the RBI viewpoint was well articulated in Majumdar 1976, Shetty et al (1976); RBI finally had to accept the multiplier approach in January 1978; there was resurgence of interest in the money multiplier approach on the part of RBI as evidenced by two RBI works Singh et al (1982) and Rangarajan et al (1984) and Chitre (1986); notwithstanding, there were two formidable limitations: (a) the lag pattern in the impact of reserve money on money stock did not receive the attention it deserved, which was particularly surprising in view of the well-recognized fact that an accurate assessment of the lag structure was the sine qua non of successful monetary management, failure to estimate the money multiplier with reasonable limits of statistical precision might have undesirable destabilizing influences on money market conditions, most of the studies discussed above simply ignored the money multiplier lag, and even in those studies like Rangarajan et al (1984), which introduced lags the choice of the lag length tended to be arbitrary, (b) the implicit

assumption of unidirectional causality in the sense of Granger (1969) from reserve money to money stock was not always true, but, empirical studies often indicated possibilities of feedback from the money stock to reserve money like Chitre (1986) in the Indian context; the presence of feedback was caused by the presence of the common component currency both in money stock and reserve money and by some other variable(s) affecting both of reserve money and money stock; the former effect would manifest itself as money stock (Granger) causing reserve money, the latter effect operated more subtly and could be inferred if the innovations in the two time-series displayed a contemporaneously correlated structure; in presence of such feedback a model could probably generate misleading conclusions, e.g. the dependence of money multiplier on the monetary base in Singh et al (1982) was suspected to be an outcome of the failure to model this feedback;

(e) **e**mpirical study on money-income and money-price causality in developing countries like Bangladesh, India, and Pakistan was still in its infancy; Jones et al (1988), Parikh et al (1988), Chowdhury et.al (1995) were among the few studies conducted on Bangladesh; Sharma (1985), Singh (1989), Verma et al (1994) were among the few studies conducted on India; Jones et al (1988), Masih et al (1997) were among the few studies conducted on Pakistan; the above-mentioned studies had major methodological deficiency; most of these studies were mainly anchored upon dealing with causal relationship in a bivariate framework; because these studies included only two variables in the model they had omitted variables bias; these causality tests therein disregarded the possible influence of other variables on money and prices; some of the studies included more than two variables though they claimed the tests they conducted as multivariate tests, actually those were bivariate causality tests in a multivariate framework, because they considered lagged coefficients of a particular variable in a single equation of the system not the other equations of the model; only a likelihood ratio test could do this job; the extension of single equation approaches to models of interdependent variables, where feedback mechanism existed, went some way with the work of Sims (1972); researchers in the 1970s began developing two-variable causality models; in the SAARC countries, however, the use of bivariate causality models could be traced back to mid 1980s; as an alternative to traditional econometric system of equations in which variables were

arbitrarily labelled as endogenous or exogenous, VAR models emerged as powerful multivariate models since the early 1980s (Ahmed 2003).

Findings of Sarma (1982)

The reported implication of Sarma (1982) was that - the fiscal authority must aim at minimizing the budgetary deficits by improving revenue collections, reducing the lags and curtailing nominal expenditure in tune with rising price levels; this would help containing the self-generating process in the price inflation and thereby lessening the burden on monetary authorities.

Nachane et al (1985)

It was reported that Nachane et al (1985) used causality-based tests like Sim's Test over the sample period is 1960-61 to 1981-82 for the empirical evaluation of the monetarists' three propositions: (i) Fed actions influenced changes in reserve money; (ii) changes in reserve money influenced changes in money supply; and (iii) changes in money supply influenced changes in economic activities in the same direction; here bivariate regressions were used to make causality inferences; Sims test was critiqued here because the length of lags chosen were somewhat arbitrary; the test result indicated an influence from nominal income and price level to reserve money; this study showed that money supply was endogenous and such endogeneity happened in the case of the central bank's role as the lender of the last resort because the discount window could never shut down; RBI studies like Singh et al (1982) corroborated this finding, by highlighting importance of credit aggregates over monetary aggregates.

Ramachandra (1983)

It was reported that - Ramachandra (1983) presented some preliminary results of Sims test for direction of causation between monetary and real variables in India for 1951-71; he found that (a) inflation and excess money supply did not boost economic growth and (b) interaction between monetary and real variables determined the money values of goods and services; these conclusions were mutually consistent, but the directions of causation running from M (money stock) to Y (output) and again from Y to M looked somewhat inconsistent though given the sequence that Y occurred, M got determined, P resulted in and then Y got consolidated and it looked consistent; the temporal precedence of real income even if taken as in a form of expected real income in the Indian context of inevitable recurring cycles, a role ascribed to money supply changes as means of finance created preceding actual changes in output and real services got vindicated in the direction of causation of Y to M; expected real income corresponded to a period t measured in appropriate units followed by M at time t and then Y, It would be the inherent structural infeasibility of the economy to bring expected income to convergence with actual by adequate measures of monetary expansion that stood out in support of the direction of causation.

Ray et al (1988)

It was reported that - Ray et al (1988) tried to study the direction of causality between M_3 and reserve money and between M_3 and price; they covered monthly data of the period April 1971 to March 1986; they found that there did not exist any causal relationship between money supply and price either in the form of instantaneous or unidirectional feedback whereas there existed unidirectional causality from M_3 to reserve money.

Nachane et al (1989)

It was reported that - Nachane et al (1989) developed five alternative models of money multiplier incorporating above two features and assess their relative forecasting performances; they were confined to aggregate money-multiplier and did not deal with the disaggregated; the sample period was April 1973 to March 1985; here broad money M_3 multiplier was estimated and forecasted.

Singh (1989)

It was reported that - Singh (1989) tested causality between money supply and prices using the methods of Granger and Sims on post nationalization monthly data as on the last Friday from 1970-71 to 1986-87 for broad money (M_3) and weekly averages of wholesale price index (WPI) during the same period; the causality test by Singh (1989) found that bi-directional causality existed between M_3 and WPI and the causality from WPI to M_3 was stronger than the reverse causality.

Findings of Rangarajan et al (1990)

It was reported that - Rangarajan and Arif (1990) presented a model of the Indian economy covering the period 1961-62 to 1984-85, which emphasized the relationships among money, output and prices; they outlined the framework of an aggregative model of the Indian economy in which the authors sought to capture the impact of a change in money supply both on the price level and output; the model focused mainly on determination of money supply and its links with fiscal operations and on the impact of money stock on output generation - while the RBI credit to finance public sector investments led to monetary expansion the investment itself led to higher output; the fiscal stimulus to growth operated through capital expenditures adding to real capital stock, which as a factor of production directly affected the output level; another feature of the model was the attempt to link credit and output through real money or credit as an additional variable in the production function, besides capital stock; both variables were expected to affect output with a lag of one year; the forces interacting within the economy caused changes in the behaviour of prices; an increase in credit led to monetary expansion; the inflationary impact of monetary expansion was neutralized only to the extent of the additional output which additional credit led to; the transmission mechanism of the monetary and output impulses works simultaneously to determine the price level with partial adjustments over time; the extent of inflation would depend on various elasticities quantifying the relationships among money, prices and output.

Findings of Sharma (1985) and Sharma (1991)

It was reported that - Sharma (1985) after using Sim's causality test in India for the period 1962-80 concluded that causality from narrow money M_1 to price level P was much stronger than the reverse causality and bi-directional causality existed between broad money M_3 and P, but Sharma (1991) re-examined the issue of causality using Granger's causality test found that there existed unidirectional flow from narrow money to price level on the one hand and on the other hand there existed a unidirectional flow from broad money to price level for the period 1954 to 1985.

Findings of Rangarajan (1998)

It was reported that - Rangarajan (1998) modelled the relationship between money, output and prices; he depicted the relationship between money and real output covering the period 1970-71 to 1992-93 in form of simple real money demand function on the assumption of that the elasticity of price with respect to money was unity; he established that it was possible in the Indian context to predict the average inflation rate in the medium term on the basis of the reduced form money demand equation.

Findings of Jha et al (2002)

It was reported that - Jha and Donde (2002) obtained the result that anticipated monetary policy mattered whereas no significant influence from the unanticipated monetary policy existed in the Indian context in contrast to Barro's conclusion for the US economy that anticipated monetary policy had no significant effects on real variable; they tried to test Barro's proposition using two methods; the first was a standard two-step procedure proposed by Barro; this study was a significant improvement over Ghani (1991); the second was a test in the cointegrating VAR framework; the results from both the tests were quite consistent; the results suggested that in India, anticipated money affected output significantly, whereas no such robust conclusion could be drawn regarding unanticipated components of money, because the Indian economy was characterized by the presence of a larger unorganized sector; thus a large part of the economy was devoid of wage indexation; since wages were not linked to prices, monetary policy even known could have significant effects; again interest rates did not fall in response to unanticipated or anticipated money growth, because they were administered and price regulation in key

sectors kept inflation low; so inflation expectation was stable over time; this made monetary policy more effective though anticipated.

Ahmed (2003)

It was reported that - Ahmed (2003) found that monetary policy played a role in Bangladesh; but this was not the case in the other two countries; he found also that interest rate and money as a block caused output and prices but output and price did not cause interest rate and money; the situation, however, was reversed for India and Pakistan; his causality tests suggested that interest rate, though controversial in developing countries, deserved to be a good policy variable in Bangladesh and Pakistan while money deserved to be a good policy variable in India; a bi-directional causality existed between money and prices in Bangladesh and Pakistan; the policy implication of such a result was that an increase in money stock fuelled prices in Bangladesh and Pakistan, which in turn led to an increase in money stock; it supported the view of real business cycle theorists who postulated that monetary changes only affected prices; Multivariate causality tests suggested that interest rate and money caused output in Bangladesh at the 6% and 7% levels of significance; so the monetary policy played a role in determining output in Bangladesh; but this was not the case in other the two countries; block causality tests for Bangladesh also indicated that non-policy variables got feedback from policy variables; interest rate and money as a block caused output and price but output and price did not cause interest rate and money; the situation, however, was reversed for India and Pakistan; Ahmed succinctly summed up the evidence from his causality tests: the role of monetary policy was more obvious in Bangladesh compared to Pakistan and India.

Brahmanada et al (2003)

It was reported that - Brahmanada et al (2003) examined the following empirical relationships: (a) the quantity of money had a direct and proportionate effect on the price level, (b) the volume of output had a negative and inversely proportionate effect on the price level, (c) the price expectation factor had a positive effect on the price level, (d) the interest rate had a negative effect on the price level; their broad conclusions were: (i) M1

had a direct proportionate effect on the price level, almost close to unity, (ii) rfeal income had a negative effect on the price level; the coefficients though high were less than that in the case of M1, (iii) when M3 was used in place of M1 the income coefficient became close to minus unity, (iv) the price expectation factor had a positive effect on the price level, (v) the interest rate had a negative effect on the price level, (vi) it seemed that M1 was always preferable to M3 in so far as effect on the price level was concerned; from a policy angle, the Quantity Theory was a useful and dependable foundation; by utilizing the interest rate, the authorities could hopefully strengthen the effect of M1 changes on the price level.

Conclusion

Regarding the econometric tools applied in the above works, it was found that Jha et al (2002) and Ahmed (2003) employed a VAR model accompanied by ECM and Johansen-Juselius procedure; others like Rangarajan et al (1990) employed simulation models containing regressions equations of variety of forms simple linear function and double logarithmic function, and also autoregressive equations of first order (AR_1) and only Ray et al (1988) employed filters for prewhitening purpose i.e. making a nonstationary series stationary. The filter technique did not seem to be popular. Even Jha et al (2002) employed ADF test in order to detect the level of integration of the series and accordingly took measures to ensure stationarity.

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