A Review of Empirical Studies on Money Supply at Abroad and in India

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1. Introduction

Amongst the many issues addressed in the economic literature, the money demand has perhaps attracted the most attention. The field of money supply has remained much ignored because of the underlying assumptions that money supply is exogenously determined by the central bank. In fact "In the world where banks use all their reserves, where there is no free reserves, and where both the banks and the public do not undertake any portfolio changes, there is no need to concern ourselves with the money supply. Once we get away from the simple mechanical link between reserves, deposits and money, the supply of money has an independent existence as an economic variable determined by behavior and subject to analysis." **(Fand : 1967)**. For years there has been continuing debate between two prominent schools of economic thought; Monetarists and Post Keynesians. The debate, which started since the publications of Keynes' General Theory in mid 1930s, became much heated in the late 1960s' and in 1970s'. The Monetarist view 'began to be recognized as a serious challenge to Post Keynesian economics. Monetarists contended that changes in money exert a strong force on aggregate demand, price level and output. The key proposition was that changes in money supply dominate short run influences on price level and on nominal aggregate demand. Bringing in continuity in the debate puts forth an argument about the role of money, which has been based upon the lack of synchronization between transactions receipts and expenditures. In such a case, it is desirable for market participants to hold an inventory of money balances. This argument can be used to develop a model, which delegates a powerful role of money in influencing the nations' money supply and has an important influence on economic activity. Managing the nation's money supply is essential so as to assist the economy in achieving a high level of employment, output, relatively stable price level and a viable balance of payment.

Now our aim is to review the literature on money supply studies at length at abroad and in India. The First part of this article deals money supply studies at aboard and second part deals with the studies conducted in India.

2. Money Supply Studies At Abroad

Most investigations of factors affecting the money stock take as a starting point total reserves or some other magnitude which constrains maximum size of the money stock for given reserve requirements **(Fand, 1967: 380)**. In this respect the multiplier plays a crucial role in view that monetary control should be exerted through control of a reserve aggregate such as monetary base.

Chester A. Philips (1920) was amongst the very early contributors of the money multiplier theory of money supply. The other contributors were **James, Harvey Rogers (1933), James W Angell and Carl F Ficek (1933)**. Their approach is a major step forward in formulation of the money multiplier theory and **Lauchlin Currie (1935)** gives an explanation of the supply of money and the degree to which it could be controlled by the Central Bank. The central theme of Currie's work is an extension of the analysis given by Phillips, Rogers, Angell and Ficek. In fact, the credit for an early attempt to formulate behavioural hypothesis about the variables whose change affects the supply of money goes to Currie. Then there was a long gap because of 1930s. Depression and its solution provided by Keynes in the General Theory of Employment Interest and Money in 1936. Lord Keynes was of the view that money is insignificant and only changes in the rate of interest affects economic activities in a very important way.

Meltzer, A.H. (1959 : 275-96) investigated the quantitative relationship between the money supply and the central bank monetary liabilities in France for the period 1938-54. He concluded that the banking system operating under fractional reserves would be subject to multiple expansion of money and increase in monetary base will yield multiple expansions in money supply. Empirical evidences prove that a close and stable relationship existed between money supply and monetary base during the period of study.

Ahrensdorf J. and S. Kanesathasan (1960 : 126-145) examine some of assumptions that are frequently implicit in monetary models of the economic system. The assumptions is that a central bank can control the money supply in a fairly automatic and reliable fashion by producing changes in the monetary liabilities or by changing legal reserve requirements. They have also examined the stability of money multiplier. The multiplier composes of the ratio of currency to money and of the required reserves plus working reserves to deposits. It is

also influenced by changes in the non-monetary liabilities of the banking system.

"The conclusion of the investigations is that the assumption of short run stability in currency and excess reserves, and therefore, in the money multiplier is not warranted. Although in most of the cases observed the monetary effects of changes in central bank monetary liabilities and legal reserve requirements exceeded those of changes in behaviour variables while in certain years the opposite was true for most of the countries reviewed. They concluded that continued observation of the currency and excess reserve ratios and their explicit inclusion in the analysis frame work would improve monetary analysis and focus attention on the feasibility of introducing further refinements (1960 : 128-129)."

Brunner, K. (1961 : 79-109) dealt with the concept of a demand function for cash assets, developed the concept of loss coefficient and with the aid of a series of additional assumptions, derived an aggregate money supply function. The money stock is explained in terms of some component of the public's demand functions for currency and time deposits, the monetary base adjusted for the cumulated reserve liberations, the interbank deposit structure, and a specific component of the banks demand for Federal Reserve Money. Though the theory has the best suggestive force with respect to the construction of hypotheses but contain no information of confirmation and testing. Thus the scheme obtained exhibits a frame guiding further investigations in the field of empirical money supply theory.

The money multiplier $(\Delta-u)^{-1}$ was derived as a measure of the systems 'built in' magnifying power. Variations in r^d have the expected effect on the multiplier; an increase in r^d reduces $(\Delta-u)^{-1}$, whereas variations in r^t are most probably of considerable smaller significance of the monetary multiplier. An increase in currency spillover rates compresses the systems multiplying power, and an increase in the spillover to time deposits raises it. The reserve deposit ratio interpreted as a measure of the banking system's degree of decentralization. The change brought about by this ratio is not uniquely determined. There is also influence of cheque collections on the money multiplier. (1961:101-103).

Karl Brunner and Allan Meltzer (1964 : 247-248) developed a money supply function and estimate its parameter. This function is a behavioral relation based on their theoretical model of the money supply process. Factors underlying the monetary behavior of banks and the public are specified and entered directly in the money supply function. Their approach moves to a more complex money supply function. They adopted high-powered money as the variable limiting the maximum size of the money stock, calling it the monetary base (B). They use the source method of computing the base. The Federal Reserve through open market operations and the discount rate directly controls this base. Other factors included in the function are currency held by the public (c), time deposits at commercial banks (T), and bank excess reserves (ER).

Cagan (1965) used the same money supply framework as Friedman Schwartz; however, he arranged the three proximate determinants in a different form. In Cagan's identity currency is expressed as a ratio to money (C/M) and reserve as a ratio to deposits (R/D).

$$M = \frac{H}{\frac{C}{M} + \frac{R}{D} - \frac{C}{M} + \frac{R}{D}}$$

Using this framework, Cagan presented a statistical and descriptive analysis of the economic factors accounting for the relative contribution of each proximate determinant to secular and cyclical change in the money stock from 1875 to 1960. The dominant factor influencing long-term growth in money has been increase in high-powered money. This, in turn, has been influenced (since 1914) equally by movements in gold stock and Federal Reserve operations. The two ratios have contributed little to secular changes in money. The cyclical movement in money was brought about mainly due to cyclical movement in the currency to money ratio.

Short run changes in R/D, which reflect to a considerable degree of changes in bank holdings of excess reserves, were found to reflect changes in economic activity. Interest rate changes have little impact on movements in this ratio. After 1914 Treasury and Federal Reserve operations were prime contributors to short run movements in high-powered money.

Friedman Schwartz (1963a) approach uses an identity to relate money; to three proximate determinants. These determinants are high-powered money (H), the deposit reserve ratio (D/R), and the deposit to currency ratio (D/C). He presented the following identity of money stock.

$$M = H \times \frac{\frac{D}{R}\left\{1 + \frac{D}{C}\right\}}{\frac{D}{R} + \frac{D}{C}}$$

The deposit to reserve ratio depends on legal reserve requirements, expectations of currency flow and interest rates. The changes in the deposit to currency ratio depend on interest rate, income and the public's preference for holding coin and currency. Friedman Schwartz concluded that changes in high-powered money were by far the dominant determinant of long term and major cyclical movements in the broadly defined money stock. Changes in the two ratios exerted an important influence and changes in the deposit to currency ratio made a significant

contribution to movements in money during mild cycles.

Leonall C. Andersen (1965a) uses the reserve available approach and focuses attention on the role of bank reserves and related factors in money supply determination. A major means, by which the Federal Reserve System affects the quantity of money, is changes in its holdings of assets, which directly change the amount of member bank reserves. Bank reserves influence the quantity of bank credit, bank deposits and the money supply. With a greater volume of bank reserves banks are able to expand more credit and hence more money supply. He (1967) concluded, "That month to month changes in money were dominated by changes in Federal Reserve holding of US government securities, changes in a variable consisting of the sum of the gold stock, Treasury account and minor Federal Reserve accounts and changes in currency held by the non bank public. At times other factors such as member bank borrowing from Reserve Banks, member bank excess reserves, Federal Reserve float and government demand deposits contributed significantly to changes in money."

In a study conducted by the **Research Department of Federal Reserve Bank of St. Louis (1962)** for the period 1950 to early 1962, it is indicated that changes in money supply do not correspond exactly with changes in monetary reserves, however, the factors creating discrepancies do not prevent a rather high degree of correspondence between changes in reserves and changes in money. Of the most factors that account for difference in timing or magnitude, are relatively minor. Similarly another study about Excess Reserves **(Research Department, 1963, 11-15)** suggests that fluctuations in excess reserves do not appear to reduce significantly the system control of bank credit and the money supply. Trend cyclical movements in excess reserves have been moderate and have been related to items such as movements in interest rates, changes in banker demands for liquidity, bank growth, and technological changes. Appropriate Federal Reserve System actions can affect these movements, according to evidence available.

Ronald L. Teigen (1964) formulated structural model of monetary sector of the United States economy, with particular emphasis on the post world war II period. To eliminate simultaneous equation bias, a careful analysis of the supply of money is developed treating it as an endogenous variable and taking as exogenous the factors over which the Federal Reserve System has more direct control. The theory is based upon the notion that the level of total reserves in the Federal Reserve system (R^T), the underlying institutions and rules (such as the legal reserve requirements in effect at any given time for member banks), and certain regular behavioral relationships, (between currency in circulation and the total money stock, deposits in non member banks and the money stock, etc.) determine a maximum attainable money stock at any given time, and that this quantity (M**) can be considered to be sum of two parts; one part which is considered to be exogenous and is based on the reserves supplied by the Federal Reserve System (R^s) and the other based upon reserves created by member – bank borrowing (B), and therefore considered endogenous.

Leonall C. Andersen (1965b) discusses the factors contributing to the discrepancy between the potential rate of growth in money as a result of Federal Reserve open market transactions and the actual rate of change in the money supply. The major factors which influence the behavior of the money supply are changes in (1) System's holding of Government securities; (2) other factors affecting member bank reserves; (3) Non monetary deposits; (4) excess reserves at member banks and (5) Currency held by the public. These factors reflect decisions of the Federal Reserve, Treasury, commercial banks and the public (1965; 12), reserve factors, reserve utilization factors, expansion ratio other components of money to affect the money supply.

Robert Weintraub (1967) analyzed the issues relating to the Federal Reserve Board's (FRB) ability to affect changes in the stock of money of particular interest in the possibility that can current with open market operations. Changes may take place in the money multiplier that will offset the board's impact on the monetary base. The result is that money stock is left unchanged. Weintraub concluded that the FRB had the power to offset antonymous changes in money and, therefore, to influence the stock of money during the 1952-65 period. Whether or not the Board's could have been frustrated by changes in the money multiplier induced by open market operations was left to open issue. He concluded that FRB did not use all of its open market power to induce growth in the money stock; he did not determine what might have happened with respect to the money multiplier if board had attempted to use all its power.

Karl Brunner (1968) in his article. "The role of Money and Monetary Policy" puts forth that a proper framework is required for rational stabilization policy. He has been a leading proponent of the monetary view of stabilisation policy. The monetarist's thesis has been put forth in the form of well-structured hypothesis, which are supported by empirical evidence. According to their proposition the actions of the Federal Reserve are transmitted to economic activity via the resulting movements in the monetary base and the money supply, which initiate the adjustments in relative prices of assets, liabilities and the production of new assets.

William R Hosek (1970) in his study aims to determine if induced changes in the money multiplier could have frustrated expansionary monetary policy at certain points in the past if such expansionary monetary policy had taken place. In order to accomplish this, it was necessary to estimate relationship between the determinants of the money multiplier and the interest rate upon which open market operations had an impact. The partial effect of

open market operations on money supply was also computed. Hosek constructed the model of determinants of the money multiplier. The specific ratios taken under consideration were the currency – demand deposit ratio[(k)], the time deposit ratio[(t)], the excess reserve ratio[(e)] and the ratio of required reserved to total deposit[(r)]. The behavior of banks and public could bring about changes in k, t and e via changes in interest rate, which in turn are induced by open market operations. The empirical results indicated that the money multiplier is responsive to interest rate changes. It varied directly with the short-term interest rates. The three months Treasury bill was used as a proxy for short-term rates. The effect was that the induced change in m tends to mitigate the impact of open market operations so far as they influence the money supply. For some of the years of examinations (viz 3rd quarter 1953, 4th quarter 1957 and quarter of 1960) the results were in contradiction. For these years the induced reductions in m was not substantial enough to nullify expansionary open market operations. The Board could have increased the money supply by the use of open market operation in each of these periods.

Meigs, A.J. (1962) address themselves to four questions (1) can Central Banks control the money supply? (2) Why don't central banks control the money supply? (3) Should central banks control the money supply? (4) Ought the world money supply be controlled? Though the empirical studies of relations between the monetary base and total money supply establish a strong basis for believing that central banks can control the money supply. Yet the author gives two reasons why they can't control the money supply. In first case when a central bank actually tries to control the money supply, those relationships, which theory and empirical analysis suggest are stable turn out to be operationally unstable. The second reason why central banks do not control the money supply is simply because they don't want to (1971 : 23).

Burger, Kalish and Babb (1971) present a procedure, the Federal Reserve could use to control money and a method for evaluating the effect of this control on the policy makers ability to achieve the GNP objectives. The procedure requires three previous months value of the money multiplier and the effect of reserve requirement changes on member bank reserves. There are two major ways in which Federal Reserve might operate to control the growth of money. One way is to estimate the money market conditions and other is the money stock control. Albert E. Burger (1971) in an article 'The implementation problem of Monetary Policy' mentioned that these two methods of money stock control are the independent of each other. Open market actions taken to determine money market conditions will influence the growth of the base, and actions taken to influence the base will affect the short-term money market conditions. The authors estimate the net source base as the control variable to achieve policy determined growth path for money. The procedure of the control of money stock is that the Federal Reserve decided the desire growth rate of money stock level for the control periods, and forecasts the money multiplier for the control periods. Then during the control periods, the Federal Reserve uses open market operations to attain the net source base such that the product (mB) equals the desired money stock levels. Implementing Monetary Policy under such a money stock control procedure requires three considerations (1) The length of control period (2) a procedure for forecasting the money multiplier and (3) the response to previous errors in money stock control. (Burger 1971:8). The simulation technique used to prove the effect this money stock control procedure would have had on the ability of policy markets to achieve GNP objectives. In both of the four year sample periods the largest percentage error in GNP levels was less than one per cent, and in each period 10 of the 16 quarterly GNP error were three tenths of one percent or less. For the four quarters of 1970, the money stock control procedure only reduced the probability associated with the 95 per cent confidence interval to 93.3 per cent. (Burger 1971:18). The multiplier base framework used by these authors is taken from fully developed specification of money supply process, within which the influence of changing economic condition on money supply process may be analysed. The percentage change in the money stock may be decomposed into the percentage changes due to net source base and the multiplier. The percentage change in the multiplier may then be broken down into the percentage change due to each of its components.

Courchene, Thomas. J. and Kelly Alex K. (1971) , aims to investigate the determinants of money supply and money demand and also investigate the interaction between money multiplier, velocity and monetary base. They have analyzed money demand in fact through the framework of money supply multiplier approach. The period of study is 1955-65. The multiplier includes the currency ratio, personal savings deposits and corporate notice deposits to demand deposit ratio and reserve ratio. The monetary base is adjusted for reserves held against government deposits. The authors (1971: 239) conclude that there is inverse relationship between m (money multiplier) and V (velocity). This stems largely from the differing impact on V and m of a change in interest rates; a rise in interest rate increases velocity and, because of the interest insensitivity of currency relative to other types of money, which increases the currency ratio, lowers the money supply multiplier. Another important conclusion drawn is that the money supply multiplier contributes significantly to changes in the money stock. The changes in multiplier results from public's altering the ratios in which it holds the various components of money. An important implications of the model relates to extent to which the base itself is and endogenous variable.

Frost, Peter. A. (1977) describe the money supply process within the framework of the Brunner Meltzer

nonlinear hypothesis. He analyses the relative merits of different ways of decomposing money supply into monetary multiplier and base. The period of study is 1961-74. The money multiplier includes the currency ratio, reserve ratio, excess reserve ratio and time deposit ratio. To incorporate the effect of changes in reserve requirements ratio of liberated reserves to demand deposit is introduced. Further decomposition of the money supply is obtained by defining the base to be net of member bank borrowing. Borrowing ratio is introduced in money multiplier. Further a multiplier is formed which reflects both the members bank borrowing and changes in reserve requirements. The monetary multiplier describes the behaviour of the public and banks only because changes in the Federal Reserves discount rate and administrations of the discount window affect member bank borrowing and changes in interest rate ceilings on time deposits affect the time deposit ratio. The purpose of decomposing the money supply into multiplier and a base is to choose definition of the base that maximizes the central bank's control over the money supply. He has adjusted the base, which describes the combined effect of Fed open market operations and reserve requirement changes on the growth rate of the money supply. In his study during the period 1961-74 short run fluctuations in the monetary multiplier played an important role in determining year-to-year fluctuation in the rate of growth in the money supply. Movements in the currency ratio and ratio of CDs to demand deposits were the major contributors to fluctuations in the monetary multiplier M (1977: 175). The author puts forth the model of forecasting the monetary multiplier.

Kaufman, Herbert M. (1977) examines one aspect of the quality of the money stock data i.e. the nature and significance of seasonal variation in the published series. He puts forth that optimal criteria is required for seasonal adjustment of time series. To assess the properties of adjusted series spectral analytic technique is employed. The necessity for adjusting the series on accounts of biasness, which occurs in the regression analysis if the series is not seasonally adjusted. While adjusting the series the objectives should be well specified.

Edward, J. Bornhoff (1977) discusses the degree of regularity of the money supply processes in the U.S. and the Netherlands. He uses the Brunner Maltzer analysis for discussion of money stock control. He deals with the problem of forecasting the next period multiplier. Regression method i.e. the single equation is estimated with the special restriction that only use of past values of the multiplier m in the prediction formulae. This makes the analysis comparable with work done by researchers at the Federal Reserve Bank at St. Louis. The official aim of monetary Policy was different in two countries over the period under review. Box Jenkins type model is developed for U.S. multiplier and compared to St. Louis researchers. Slightly more involved Box Jenkins models are also applied to various multipliers of Netherlands. The conclusion is that in this country, with its highly open economy, accurate multiplier predictions would have also been possible.

Buttler, H.J., Gorgerat J.F., Schiltknecht, H. and Schiltknecht K. (1979) have developed the models that can be used to control the money stock. It is assumed that a specific stock target M* is fixed for each month. If money multiplier can be correctly predicted, the monetary base (B*) needed to achieved the money stock target is

B* t =M* t/mt

Where m*t is predicted multiplier. The authors discuss some of the features peculiar to the money supply in Switzerland and establish the hypothesis for the model used to predict the multiplier. The adjusted monetary base is used in order to analysis money supply processes, which is obtained by deducting advances to commercial banks from monetary base. The period of study is January 1950 to August 1976. The hypothesis was tested with monthly data. The result (1979:333) of the empirical study indicates that the money multiplier can be reliably predicted. From a technical point of view the control of money stock became easier in future. The results also show that in the very short run, changing the monetary base has little impact on the money stock. If the money stock growth deviated from the target, this could be corrected in the short run only by drastic changes in the adjusted monetary base. The monetary base must be corrected in small steps. This will ensure money stock growth target in long run and that money stock will not fluctuate sharply around the set path.

James, M Johannes, and Robert H Prasches (1981:229) aims to assess the choice of a bank reserves target by examining how well the central bank could have controlled the new monetary aggregates M_1B and M_2. Several interesting results emerges, first, net monetary base and monetary base are better short run control aggregate than total or non-borrowed reserves. Second, acceptable tolerance limits for longer run average monetary growth should be achievable using any reserve aggregate. Third, it make little difference as far as control is concerned whether the target reserves aggregate are those defined by the Board of Governor or those define by the St. Louis Federal Reserve Bank, consistently for they are just different components.

The authors used the component model as those used in **Johannes and Rasche (1981: 456)**. The result depicts that the multiplier forecasts for all the control aggregates are essentially unbiased. Further there is little evidence of first order autocorrelation in the forecast errors of any of the multiplier. The result reveals that there is little difference as far as multiplier forecasting is concerned between the Board of Governors defined control aggregates and the St. Louis aggregates. They concluded (1981: 311) that an operational reserve aggregate control procedure does exist that would allow the FOMC to achieve its target ranges for the growth of monetary

aggregates. Narrower short run target growth ranges can be set if the gross or net monetary base is used as the control aggregate rather than total or non-borrowed reserves. For longer run control it makes little difference which control aggregate is used because any of the alternative control aggregates discussed here should allow the FOMC to hit its target growth rate for monetary aggregates plus or minus one per cent.

Thornton, D.L. (1982: 22-34) reviews three frequently suggested change in Federal Reserve operating procedures to achieve more stable short run monetary control: monetary base targeting, tying the discount rate to the market interest rate and adopting a system of contemporaneous reserve accounting. Base targeting procedure would likely result in greater short run monetary control if most of the shocks came from demand side as compared to supply side. Adopting a system of contemporaneous reserve accounting also should make easier to hit a base target, since it would no longer be necessary for borrowing to respond to differences between a predetermined level of required reserves and an amount of reserves consistent with the base target.

3. Money Supply Studies in India

Though some non-econometric studies of money supply in India were undertaken after 1960, econometric studies have been practically non-existent as compared to those in the Western World except one important study on Money Supply conducted by **Lodha, S.L. (1988)** which aimed to develop appropriate definition of money stock and its components suitable for Indian context, to bring out the determinants that influence the money stock and to compute the relative contributions of these components both on annual and quarterly basis. In this study fundamentally single equation, one way causation approach has been used. This study on money supply in India rated as an excellent piece of research.. The reason for absence of econometric studies was not apathy towards the subject but bottlenecks in the collection of money supply statistics and difficulty in the generation of related data. Secondly, the trend was in tune with what was happening in the rest of the world, where until very recently almost no work had been done in the field of money supply theory. The third and more important factor was India's preoccupation with economic planning and, therefore, the theory of economic growth rather than monetary theory attracted the attention of economists. Even in monetary theory, studies of demand for money were rather ahead; for the supply of money was treated as exogenous and, therefore, no need was felt for money supply study as such. Studies regarding money supply received serious consideration only after the Indo-China (1962) and Indo-Pak (1965) wars and four bad crops in 1970s, which increased the price level by 10 percent per annum by 1965 and by 13 percent in the following two years. The recession of 1967-69 was again conducive to this programme. All these factors led to the production of some studies about money supply after 1960. hence, whatever empirical works are available today are of rather recent origin. Our aim in this article is to survey the available studies about money supply in India and produce their results, and to decide whether there is scope for further research in the field of money supply and if yes, on what pattern it should be conducted.

Raman (1957) may be regarded as a first to study about the money supply in India for the period 1914-50. Raman regarded high-powered money as autonomous as its issue determine by government authority rather than by any rule. Thereafter, **Bhatia (1961), Bhatt (1961), and Narvekar (1963)** studied about the relationship between the money supply and reserve money.

The study conducted by **Gupta, G.S. (1972 : 33-51)** is perhaps the compressive study about multiplier model of money supply. His study was related with the period 1948-49 to 1967-68 and he took almost fifteen determinants of money supply. He hypothesized that the change in money supply is a function of the behaviour of all the sector of the economy and thus challenged the hypothesis of exogenous determine of money supply. In fact, the model formulated by Gupta is simply an extension of Friedman-Schwartz (1963) and Cagan's (1965) money multiplier model. For the whole period of study the value of money multiplier varied between 1.33 to 1.50.

Pathak's (1972: 129-137) analysis of money supply is based on the hypothesis that money supply is endogenously determines through a process of market adjustment. The period of study is 1957 to 1970. He has used regression and correlation analysis to analyse the behaviour of these variables. The variables considered are Reserve Bank's credit to commercial banks and to the government, commercial banks credit to public, discount rate and call money rate. The central bank operates through monetary base the chief elements of which are central bank's credit to government and bank, foreign assets and balance of payment. The willingness to borrow of commercial banks from central bank is also influenced by discount and the call money rate. Empirical evidences supported the hypothesis. The result revealed that all the variables jointly explain 96 percent variance of the dependent variable. The regression value of central bank credit to government and commercial bank credit to public was also significant. His study also revealed that the supply functions relating to stock of money have remained stable.

The study conducted by **Bhattacharya (1972:504)** for the period 1949-50 to 1967-68 proved that the stock of money is not wholly determined by the amount of monetary base and the reserve ratios but it also depended on market rate of interest. Further he reached the conclusion that money supply is not an exogenous variable as it is very much affected by the interest rates.

The First Working Group for Study of Money Supply in India (RBI: July 1961) explains the process of multiple credit creation under fractional reserve system concluded that the extent of creation of bank money by the banks not depend only on the ratio of bank money to bank reserves, it also depends on the ratio of bank reserves to government money. If magnitude of increase in government money is known, then it is possible to forecast money supply on basis of certain normal relationship between money supply and government money. The report further explains that marginal ratio is more meaningful for forecasting variations in money supply.

Gupta S.B. (1976:118) presented the theory of money supply determination in its simplest form. The theory states that the supply of money (MS) is a highly stable increasing function of high powered money alone. He gives the following equations of money supply determination.

$$Ms = m.H \dots\dots\dots\dots I$$
$$Ms = a + bH \dots\dots\dots\dots II$$

Where m, a and b are positive constants. In the first equation Ms is a proportional functions of H whereas, in II equation it is a non-proportional functions of H. m is both the average and marginal multiplier while b is only a marginal multiplier. He is of the opinion that for short run forecast and monetary planning, second equation is more reliable and useful. The factors governing H, are largely policy controlled, whereas the factors governing m are largely endogenous, i.e. are such as depends on behavioural choices of public and banks. Policy changes do have some effect on m but usually this effect is very small. Further the change in m is highly predictable and that this change in m is going to be sufficiently slow. This further strengthens the usefulness of money multiplier theory for monetary planning and for predicting the money supply consequences of particular policy actions.

Mujumdar (1976: 371), Shetty, Avadhani and Menon et al (1976: 571-574) in their articles criticises the money multiplier theory of money supply on the ground that it considers only the monetary factors and ignores the real factors. The real factor, for instance output and investment influence the demand for bank credit as the banks desire and have the capacity to supply credit.

Chona's (1976:608) study covers the period 1951-52 to 1974-75. He focuses on the factors affecting money supply in terms of primary money created by RBI and the secondary money created by Commercial banks and uses the multiplier model to explain the variation in money supply. He disintegrated monetary liabilities-accounted for variations in money supply in foreign central bank, net credit to government and policies of central government. Likewise, the reserve ratio is subdivided into two elements, i.e. required reserve ratio and excess reserve ratio. The components – net credit to the government, net foreign assets of the central bank and ratio of excess-reserve are regarded exogenous while reserve ratio is ascribed to the behaviour of Commercial banks and would thus be exogenous from RBI point of view (1976:609-610). During the period of study, the value of broad money multiplier (m_2) reveals that there was no sharp fluctuations in its value. It rose by 16.7% or less than one percent annually. As such, it should be possible for the Reserve Bank to estimate the money supply in a predictable manner. The L effect far exceeded the K effect on money supply. Thus, it implies that control of money supply can be exercised principally through change in the monetary liabilities. Another important finding was that net bank credit to government was major factor causing change in monetary liabilities. It leads to expansion in money supply. In the study conducted by **Swamy, (1976:319-320)** for the period from 1951 to 1971, it is indicated that high powered money had explained 81 per cent and money multiplier 19 per cent of year to year change in stock of money (m_2).

Madhur (1976:349) examines the three assumptions of money multiplier given by Majumdar (1976). According, to him the first proposition viz. the supply of money is highly stable function of high-powered money alone is not carefully worded. It is necessary to adjust the data of high powered money for the statutory reserve changes, because the statutory reserve which the commercial banks keep are not available to the banks to meet their currency drains. The equation of adjusted high powered money is:-

$$H = H - RR (AD).$$

Where H* is the adjusted high-powered money, H is total high powered money, RR is required reserve ratio and AD is the aggregate deposit of the commercial banks.

The Report of the Second Working Group (RBI: Jan. 1977: 70-1342) on money supply examines the various concepts of money supply with reference to Indian economy and factors determining its stock. It concludes that the determining of money supply is the result of complex process of interaction between monetary and real sectors. However, the study reveals that multiplier approach is of little relevance in Indian economy where credit planning has been adopted for a considerable period. However, for long run projections its approach is relevant.

Shahi (1978) examines empirically the relationships between monetary base and the money multiplier and their contribution to the changes in money stock for the period 1949-1976. The use and source aspect of monetary base and components of multiplier are discussed at length. Shahi reveals the various concepts of monetary base from uses side. When the central bank does not allow for the discounts and advances to commercial banking system, such a base is termed as the gross source base. Subtracting discount and advances from gross base derive the net source base. When reserves are held over and above legal requirements, then these are known as excess

reserves (ER). Further, when borrowing is deducted from excess reserves, free reserves and total reserves constitute the commercial banking system's 'non borrowed reserves'. If the monetary authority's objective is to control the base, then it is the gross base that is of relevance (1978, 137-138). In the sample period the multiplier value was between 1.3 to 1.6. The mean value of multiplier was 1.4, which was much lower than in developed industrial countries. This was on account of high proportion of currency with the non-bank-public on the average. Shahi has also considered the source side of the monetary base. Given the value of money multiplier any change in source components of the monetary base affect the aggregate value of the base hence the stock of money. The major items on the source side are foreign assets, government securities and discount advances.

Rao, D.C. T.R. Venkatachalam, at el. (1981) conducted study on short-term monetary model building. The paper is prepared with intention to forecast the monetary aggregates. Money multiplier, in their opinion, fluctuates and main cause of its fluctuation is ratio of currency to deposits. In the model they considered four behavioural equations and four identities and relationship is estimated on the basis of using annual data for the period 1970-71 to 1979-80. The four behavioural equations considered are currency demand, the supply of bank liabilities, national income at current prices and demand for time and demand deposits. Through this model they reached to the conclusion that the public's demand for currency has a crucial role in monetary analysis for many reasons.

Sharma (1982 : 57-64) related supply of money to the high-powered money through the multiplier. Changes in high-powered money are brought about through Central Bank's claims on government, commercial and co-operative banks and changes in foreign exchange assets. These in turn bring about changes in money supply. Change in RBI credit to government is function of the fiscal deficit of the government. The changes in money supply apart from other factors are determined by government expenditure and revenue, governments draft on foreign saving and domestic borrowing. Bank credit to government is determined by government expenditure and revenue while bank credit to commercial bank and foreign exchange assets of banking sector are assumed to be exogenous. The period considered for the purpose is 1961-62 to 1978-80. The results accorded well with the hypothesis.

Mody and Thaker (1984 : 17-23) have tested the behavioural theory of money supply, using a portfolio balance approach. Nominal income is taken as link variable between financial and product market. The sources and uses of high-powered money were considered. The main sources on change in high-powered money are variations in the assets of central bank like its claims against government, commercial and co-operative banks. Foreign exchange assets held by the Reserve Bank also constitute the source of variation in high-powered money. Claims of government and net foreign exchange assets are treated as exogenous variables. The period of study is 1955 to 1979. In this study, income is an important explanatory variable and is found to be statistically significant (1984 : 20). Therefore, the approach of using nominal income as link variable in deriving the multiplier appears to be appropriate. The estimated value of multiplier was 1.67. The observed value of multiplier was not significantly different from theoretical value of multiplier. The authors propose that since money multiplier is a long-term process, there is no point in observing yearly changes. The adjustments presumed in theoretical model take time. Therefore, it is better to observe quinquennial changes. They conclude that money multiplier is quite stable as far as long term relationship is concerned. This finding is of immense value for planned monetary expansion through deficit financing and monetary policy.

Kulkarni and Miller (1986) examined the influence of institutional and structural factors on the multiplier. The period of study is 1950 to 1979. The two monetary aggregates considered are M_1 and M_3. The structural changes in Indian economy were shift from unorganized to organized money and capital markets. The drift from demand deposits towards time deposits led to rapid increase in M_3 in comparison to M_1. The conclusion arrived at on the basis of empirical results (1986 : 16-17) are that there is strong link between monetary base and money stock in long run. Money multiplier growth contributed to money supply growth but on smaller scale. Further the model explains the relationship between short run movements in money stock by short run movements in base money. The currency ratio explained most of adjustment in M_1 whereas, currency and time deposit ratio accounted for adjustment in M_3. Further, the currency ratio and time deposit ratio exhibited a high degree of predictability over the sample period. It is further concluded that the proper definition of the money stock for policy purposes might be M_3 rather than M_1, because with accelerating growth rates it has best sample forecasting accuracy.

Chitre's (1986:1-117) Quarterly Prediction of Reserve Money concentrates on examining the variations in the multiplier and reserve money for the forecasting and control of money stock. Reserve money dominates the multiplier in bringing about variations in money supply. But, minor variations in multiplier could cause absolute changes in money stock. The period of study is 1970-71 to 1983-84. The cyclical fluctuations of reserve money, money stock, currency to deposit ratio, demand deposit to deposit ratio, time deposit to deposit ratio and bank reserve to deposit ratio of scheduled commercial banks are studied after the adjustment and removal of trends in these by using a 72 months moving average. Concluding, Chitre remarks that multiplier can be predicted one or two quarter ahead with small error. The small standard error shows the stable dependence of money multiplier

process on Key economic variable viz. quarterly real income, interest rate on fixed deposit, call money rate, and changes in reserve requirements.

Bhole's (1987) period of study is 1956-57 to 1981-82. He tried to define the money supply on the pattern used by Reserve Bank of India, which includes the deposits of the post office saving banks. Bhole aims to find out whether there are enough empirical evidence in favour of money multiplier theory to make it a major test of money supply analysis and control in the Indian milieu. The empirical results (1987:949-950) show that there has not been a close correspondence between the variations in money supply and high-powered money. As the currency component of money supply has declined, the relationship between money supply and high-powered money has become all the more unstable. The wide fluctuations in high-powered money also indicated the lack of perfect control of authorities on high-powered money. The average money multiplier increased from 1.4573 to 2.1463 during 1957-82. The level of marginal multiplier also varied from 1.132 to 2.015.

Subrahmanyam, G. and S.B. Swami (1988:121) aims to investigate the empirical magnitude of the money multiplier through a link variable connecting the real and monetary sectors of the Indian economy and to review the stability evidence on the money multiplier and critically evaluate the RBI policy stance on the multiplier issue. Concluding, he remarks that the behavioural model of money multiplier provides a good approximation to money stock determination in India. It holds significant potential for use as a powerful tool of analysis and guide to monetary policy targeting. The only bit of evidence that is supportive of the position of the Second Working Group turns out to be apparent only but not real in the sense, the multiplier is still, largely explained by the highly predictable currency ratio alone (1988: 129).

Lodha, S.L. (1988) aims to develop an appropriate definition of money stock and its component suitable for Indian context to bring out the determinants that influence the money stock and to compute the relative contributions of these components both on annual and quarterly basis. The period of study is 1950-51 to 1977-78, a period which covers 28 years.

In this study fundamentally single equation, one-way causation approach has been used. Broadly defined money stock M_2 is taken into consideration. The equation considered is as follows:

$$M = \frac{1 + c + b + t}{\{1(rs + re)(1 + t) + (c + b)\}} H$$

The ratios considered are currency ratio, time deposit ratio, other deposit ratio, liability ratio, excess reserve ratio and required reserve ratio. The change in money stock has been calculated by following methods :

1. By calculating Money Multiplier on the basis of Ms/H.
2. By inserting the actual values of the ratios in the money multiplier formula and
3. By inserting the estimated value of the ratios in the formula.

Concluding, the author remarks that on the basis of quarterly data the contributions of high-powered money and money multiplier to money stock comes to 76.27 and 23.73 percent respectively. When interpreted in terms of five yearly basis the contribution of money multiplier emerges highest to 46.63 percent, and high-powered money contributes to the extent of 53.27 percent. Thus in long-term perspective, it is clear that changes in money stock have been caused predominantly by changes in the high-powered money. But from a short-term perspective, the impact of changes in the high-powered money is apt to be less certain on money stock (328-29). High-powered money, as a policy variable would increase the effectiveness of the monetary policy in the long run.

Menon (1988) analyses the factors, which bring about the variations in money supply. He brings out the diminishing role of money multiplier in inducing monetary expansion and the enhanced role of reserve money. The period of study is 1960-61 to 1987-88. The data revealed that the multiplier of both M_1 and M_3 grew at slow pace over the years. The growth in money multiplier M_1 per annum that was 1.0 percent during 1960-65 accelerated to 1.6 percent in 1965-70. Its rates of growth declined from this level to 1.01 percent during the period 1971-78. the multiplier in the period subsequent to March, 1978 are not comparable to early period because of change in method of classification of saving deposit into demand and time liabilities, which affected the quantum of M_1 in circulation.

Nachane D.M. and D. Ray's (1989) article 'Non-Linear Dynamics of the Money Multiplier' – Selected Case Studies examines the non-linearity in the money multiplier using a group of tests. These tests are still not popular among economists. They considered multipliers of five countries related to both M_1 and M_2. However, this paper is not related with the procedure of estimation of money multiplier but simply with the linearity or non-linearity which will be useful for the purpose of forecasting the value of money multiplier and hence money supply.

Rangarajan (1989) in his study of money supply lays the condition that for effective regulation of money supply there should be predictable relationship between reserve money and money supply. The money multiplier is affected by the ratio of currency to deposits and the cash reserve ratio. He puts forward that money multiplier not only depend on these two ratios but also on demand for credit. The addition of reserve money can only add

to the credit creating capacity of the commercial banks, but the actual expansion would depend upon the demand for credit, which would in turn depend on the behaviour of real sector. While this position is theoretically valid it is to be noted that in the Indian context with an administered structure of interest rates with varying rates of interest for different activities demand for credit is not a binding constraint (1989- 1990)

Mammen, Thampy (1990) in an article 'Supply and Demand for Money' discusses assumption of stability of money multiplier and hence possibility of controlling the money stock by controlling the monetary base. However, the stability of money multiplier depends upon the public's demand for currency and time deposits and banks' demand for excess reserves. The aim of this paper is to evaluate the effectiveness of monetary policy in controlling the monetary variables and the impact of government deficit on the later.

D. Rath and et. el. (1998) in the article 'Does Money Supply in India' follow a mixed portfolio – loan demand model submitted at the conference hosted by IGIDR Mumbai examined the endogenity of money supply. The paper distinguished among the three competing models of the money supply process namely, pure portfolio approach, pure loan demand approach and mixed portfolio – loan demand approach. The author concluded that in India the mixed portfolio – loan demand approach best described the money supply process.

Lodha, S.L. (2004) in Determination of Money Stock in India (1980-81 to 1999-2000) explains the framework for analysis of money stock determination in a simple equation which expresses money (M) as the product of High Powered Money (H) and Money Multiplier (m) in the identify M=mH. Thus, multiplier in this process is a connecting link between high-powered money an money stock. If the components of high-powered money and money stock are put together, the importance of money multiplier emerges:

$$H = C + R \text{ (Currency + Reserves)}$$
$$M = C + D \text{ (Currency + Deposits)}$$

In H and M, R and D are not common and the amount of D would always be some multiple of R which means that it is the reserves of commercial banks upon which deposits are build up. Since the money stock identity is expressed in multiplicative form, the change in money stock can be separated into two components – the change in high powered, money (ΔH) and change in money multiplier (Δm). This contribution is estimated using logarithms (base 10) on the basis of earlier identify M = mH as follows:

$$\log M = \log H + \log m \qquad \text{....(1)}$$

and $$\Delta \log M = \Delta \log H + \Delta \log m \qquad \text{....(2)}$$

and their percentage contribution is estimated as

$$\frac{\Delta \log H}{\Delta \log M} \times 100 + \frac{\Delta \log m}{\Delta \log M} \times 100 \qquad \text{....(3)}$$

He concludes that the role of high-powered money emerges more important in affecting the money supply both in short and money supply both in short and long period, in comparison to money multiplier. He completed this research work under the Senior Fellowship, awarded by Indian Council of Social Science Research, New Delhi (India) during the period 2002-2004.

Lodha, S.L. (2012) in his book Determinants of Money Stock : With Special Reference to India, published by LAP Lambert Germany, concludes that on the basis of data for the period of 1980-81 to 2011-2012. The money multiplier emerges less important money comparison to high-powered supply in India. This conclusion increases the role of Reserve Bank of India in controlling the money supply in India.

4. Conclusion

From the historical survey of money supply theories it is evident that traditionally money supply has been seen in three ways : (i) as the product of gold and/or silver stock, (ii) as created by the central bank by means of open market operations and (iii) as a result of budget deficit financed by printing money. During the last 60 years, three different kinds of econometric models have been produced. These are (i) multiplier (ii) structural and (iii) reduced form models to determine the amount of money supply. During the half century from 1920 to 1970, economic analysis of money supply was based on Phillip's multiplier approach. Under this approach, the bank behaviour is described by a set of fixed coefficients. Multiplier approach takes for granted a predictable relationship between bank reserves and the money supply. It is positive function of demand deposits ratios and negative function of reserve ratios. As Jurg Niehans (1978) notes, "It may worth pointing out that, except for the inclusion of time deposits and the omission of equity the multiplier is identical to the deposit multiplier for an individual bank". The purpose of structural and reduced form models are to specify the structural relationships. There are three sectors in this model: (i) Public (ii) Commercial banks and (iii) The Government. The interaction of these sectors determines the total amount of money supply. It is clear from the brief survey of money supply studies that have so far been undertaken in India and abroad that the stock of money is the product of high-power (or base) money and value of money multiplier. It is also evident that high-powered money has played a more significant role in determining the money stock than the value of money multiplier. The different components of

money-multiplier have also been estimated.

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