Demand for money in india an econometric investigation economics essay

[Economics](#)

Abstract

The demand for money is at the heart of how macroeconomic policies should be conducted effectively. In most of the developed and developing countries, policymakers have frequently questioned whether the money demand is stable over a period of time. According to Friedman the demand for money function is the most stable macroeconomic relation and also one of the most stable and important components in the analysis of economic behaviour. In this paper we have briefly surveyed various theories of demand for money. We have estimated demand for Narrow Money [M1] and Broad Money [M3] functions for Indian economy using annual data covering time period from 1950-51 to 2004-05. In order to determine the relationships between Narrow Money and Broad Money and other important macroeconomics variables such as GDP, Real income [YR], WPI, and Short term interest rate [Sir], we have estimated several estimations involving various combinations viz. linear, log linear, percentage change of these explanatory variables. When we used OLS method for estimation it is found that majority of estimated models are suffering from problem of autocorrelation. To get rid from this problem and for better estimates we have used Cochran-Orcutt a more sophisticated method to solve the problem of autocorrelation. Keywords: OLS, Cochran-Orcutt, Money Demand, IndiaJEL classification: E41, E52

Introduction

Money occupies an important place in the evolution of Economics as a science. There is hardly any activity in economy today which is not related to money. The world of economic transaction has expanded and Monetary

Economics has developed as a full fledged branch of Economics. According to Friedman (1956)[1]' in monetized economy; money as a medium of exchange provides facilities of separating sales and purchases of a person'. According to Keynes there are several motives to hold money and they are: (i) Transaction motive (ii) Precautionary motive (iii) Speculative motive. Another monetarist Jonson P D (1976)[2]said that ' money is such a rare commodity that is not being demanded of itself but it is demanded because other goods can be purchased through it'. The demand for money is at the heart of how policy should be conducted effectively. In most of the developed and developing countries, policymakers have frequently questioned whether the money demand is stable over a period of time. According to Friedman (1956), the demand for money function is the most stable macroeconomic relation and also one of the most stable and important components in the analysis of economic behaviour. The theory of money demand is one of the most enduring and debated issues in Economics.

Review of literature

Gujarati Damodar (1968) applied the partial adjustment model for Indian data covering the time period 1948-64, and found that demand for money was significantly influenced by real income with long run real income elasticity placed at 1. 5. The long term interest rate (i. e. yield on government securities with maturity of 20 years or more), however, turned out to be insignificantGupta K L (1970) as well as Singh Balbir (1970) worked for a somewhat extended period, 1949-66 and found real national income rather than wealth as the appropriate scale variable. The findings in respect

of interest rate, however, were diametrically opposite, the former found short term interest rate to be significant while the latter found both short term as well as long term interest rate to be insignificant as explanatory variables. Divatial and Venkatachalam (1972) found that, for the period 1952-68, income (defined as net household disposable income) as well as short term interest rate and long term interest rate taken together provide a satisfactory explanation of household money demand. Bhattacharya (1974) using the two stage least square method, showed that personal disposable income performed better than national income as a scale variable in explaining narrow as well as broad money demand. Gupta Suraj (1975) found that, during the period 1950-74, money demand in India was a proportional function of income but short term interest rates (proxied by 12 month time deposit rate and the bazaar bill rate) were statistically insignificant. Laidler (1977) in his critical review of literature on Money demand theory had found that wealth is the most important explanatory variable as far as the U. S. A. economy is concerned. On the same line Meltzer in his study had regressed both income as well as non-human wealth together and separately on both the money stock M1 and M2 for the period of 1900-1958 in U. S. A. He found that the demand for money function is more stable when wealth is considered as the independent variable. He was further in favour of using permanent income rather than current income. Burnner and Meltzer were in opinion of utilizing wealth variable than current and permanent income in explaining changes in demand for money (for both narrow and broad definitions). Laidler (1977), Metlzer (1963), and Goldfeld (1973) have found that price level has not influenced demand for money. On

the contrary S. B. Gupta (1979) found that the price level elasticity of demand for money is not unity in India. Pure economic theory does not provide any rationale as to the correct mathematical form of the money demand function. Generally three major functional forms dominated in the empirical literature: (1) Linear-additive (2) Log-linear (3) Linear-non additive [see Feige and Pearce (1997)]. However, the Log-linear version is the most appropriate functional form, as it gives the elasticities directly. Sharma (1978) covering the period from 1950-51 to 1971-72, found that income elasticity of money demand in India exceeded unity, the money demand was interest elastic and that permanent or expected income performed better than the measured income as a scale variable. Trivedi M S (1980) in his study on India for the period 1951-52 to 1974-75 on the role of inflationary expectations in the money demand function had found the appropriateness of the both the definitions of money viz. M1and M2 (that is for narrow and broad money). He had considered both the expected and permanent income as scale variables. He used adaptive expectation hypothesis to derive permanent income. The orthodox quantity theory gave quite satisfactory results. In another study Trivedi M S (1983) utilized a second order difference equation to regress demand for money on the permanent income and anticipated rate of interest to explain the behavioral pattern in per capita real stock of money. In terms of goodness of fit criterion, the orthodox quantity theory was found to be poorer for M1 than M2 . But when measured real income was utilized as a scale variable with expected inflation rate, results were better in case of M1 than M2. A very low R2 indicated that for Indian Economy the per capita real permanent income is more appropriate

scale variable in money demand function. In an extension to his previous study and using the same methodology of estimation of model with second order difference equation, Trivedi M S (1984) assessed the role of variability of inflation rate in the demand for money function with both the definition of money i. e. M1 and M2. There was hardly any difference in the results of both the equations based on M1 and M2 except slightly higher R2 for M2. He had used per capita real income which is the value of NNP at constant prices deflated by total population as one of the scale variables. In another attempt, to analyse the demand for money function in the light of literature, Trivedi M S (1992) tried to analyse the empirical significance of (1) Measured real income (2) Private real final consumption expenditure and (3) Permanent real income as the scale variables in money demand function. He concluded that unlike M1 equation the anticipated rate of change in nominal income turns out to be comparatively a better explanatory variable vis-à-vis anticipated rate variable. Paul Thomas (1981-82) on Indian data for the year 1951-52 to 1977-78 found significant relation of demand for money in India with permanent income, inflationary expectation and variability of inflation(Independent variables). The Linear form of regression was used with both the definitions of money along with income in variety of combinations. He found that the both M1 and M2 provide similar results, so there is nothing to choose between them. Inflation when introduced as explanatory variable reduces the autocorrelation problem, thus an important variable (variability) was left out. Permanent income was found to be better scale variable than current real income. In almost all the equations the correlation between inflation, expectations and the variability of inflation was found to be very

small. Bhole (1985) estimated money demand functions separately for M1 and M3 using annual data for 1950-51 to 1979-80 with income, interest rate (proxied by one year term deposit rate), expected inflation rate (measured by three year moving average of actual inflation rate) and the lagged money stock as the explanatory variables. He used linear, rather than the conventional log-linear model with nominal and real money stock as separate dependent variables and obtained generally satisfactory results. Mishra G D (1985) by taking model $M = a \, y_\&$ found that in nominal terms, Random Coefficient Method (RCM) gives an improvement over ordinary least square method in the sense of the income elasticity of demand for money. Values under both the methods were significant with almost the same explanatory power (R2= 0. 99). The values of $_\&$ (income elasticity) by the RCM method was 1. 0528 as compared to 1. 0176 (OLS method). If the value of R2 is given any justification, for the choice of variable as specification of model under RCM, the model in nominal terms may be chosen for interpretation. On such ground, he had generated the income velocity series for India from 1950-51 to 1981-82 which is quite consistent and is in conformity with the original behaviour. The results obtained with deflator model i. e. model in real terms estimated by OLS method gives almost the same result as given by the model in nominal terms. B is highly significant with its value 1. 0578, R2 being 0. 939. Gupta Suraj (1986) using alternative specifications of the demand function for money for India for the period 1950-51 to 1975-76 (annual data) has arrived at the following conclusions: Demand functions in logarithmic form (except for interest rate variables) are seen to give better results than the one in simple linear form. The short term

interest rate (12 months time deposit rate of bank) gives better results when entered in the original form in regression equation with log M / P as the dependent variable than in log form. In all the equations coefficient of P (WPI) has a negative sign indicating that a rise in the level of P lowers the real demand for money. This goes against the usual ' maintained hypothesis' by which it is assumed that the real demand for money is homogeneous of degree zero in P. Rangarajan C (1988) estimated the demand function for broad money in the inverted form with the general price level being dependent on nominal money stock and real income. Based on annual data covering the period 1961-62 to 1986-87, this study found the real income elasticity of demand for broad money was of the order of 1. 9. Ramchandra Prasad U (1989) in his study on Indian economy for 1970-71 to 1987-88 had attempted several money demand models using log-linear form of equations. He experimented with both the money definitions with various explanatory variables like NNP at factor cost and current price, long term and short term interest rates, both the price indices WPI and CPI and inflation rates based on WPI and CPI. He further used call money rates of major commercial banks as well as expected inflation rates based on lagged values of the previous year. The main conclusions were -major determinants of demand for money in Indian context are nominal and real national income, long term interest rate, current inflation rate and inflation rate with one year of lag. In the light of the above review of earlier studies on the subject, it was decided to try out various specifications of econometric models and various combinations of the explanatory variables influencing the demand for money in India.

Methodology

The basic methodology adopted in this study is the single / multiple equation models estimated with the Method of Least Squares (MLS) / Ordinary Least Square (OLS). Alternative specifications of various equations like liner and log linear are examined. The variables are also alternatively examined in terms of actual values and percentage change. The specifications of various relations are based on the earlier studies on the subject as well as economic and econometric characteristics.

DatA Sources

The data on Gross Domestic Product at factor cost [GDP] were collected from various issues of Economic Survey, Government of IndiaThe Data on Wholesale Price Index [WPI], Broad Money [M3], Narrow Money [M1], Short term interest rates [Sir][📖]were obtained from Handbook of Monetary Statistics of India, Reserve Bank of India (2006). Our basic data refer to the time period 1950-51 to 2004-05.

Demand for money function for India: analysis and interpretation

In order to determine the relationship between Money supply (M1 and M3) and other important macro economic variables like GDP, real income [YR], WPI and Short term interest rate [Sir], we have fitted several equations involving various combinations of these explanatory variables.(I)In the first set of equations, M1 (M3), Log M1 (Log M3) and percentage change in M1 (M3) were taken as the dependent variable separately. These dependent variables were regressed on (i) GDP (ii) Log GDP and (iii) Percentage change in GDP respectively. Thus we obtained 6 sets of estimated equations – 3 for

M1 and 3 for M3. The objective of this exercise was to see which transformation of the dependent variable - absolute, log or percentage change – gives the best results and also to see whether the problem of autocorrelation remain present in various equations or not. [Equations 1 to 6 in Table 1. 1](A) The relevant estimated equations are presented in Table 1. 1. It is found thatOut of the 3 versions (absolute value, log and percentage change) in two versions viz. absolute and log form, the value of R2 is very high for both M1 and M3 indicating a good fit. However, the model incorporating the percentage change of variables had quite low R2 – around 0. 25. This shows that perhaps the percentage change in GDP is not an important determinant of percentage change in money supply (both M1 and M3). Our results also support the conclusions of Trivedi M S (1980), who used ' adaptive expectation hypothesis' to derive ' permanent income' which he used as the independent variable that the orthodox quantity theory gave quite satisfactory results. Also, in the case of percentage change version, autocorrelation was found to be absent in the case of M1, but not in the case of M3, even when the values of Durbin Watson (DW) statistic had improved substantially. The elasticity of Broad Money (M3) with respect to GDP is higher (1. 22) than that of Narrow Money (M1) with respect to GDP (1. 01), as obtained in the log version. These values also indicate almost equiproportional change in the dependent and the independent variables. It is noteworthy here that Mishra G D (1985) who used the Random Coefficient Method (RCM) for estimating the equation also found that the values of income elasticity was 1. 0528 as against 1. 0176 for OLS. Thus our results are also in conformity with the values obtained earlier by him.(B) Now

replacing GDP by Real Income (YR) which is GDP / WPI, the same sets of models were estimated as mentioned above in (A). It was found that [Equations 7 to 12 in Table 1. 1]As in (A), the value of R2 was quite high (around 0. 98) in the case of the actual values and the log values of the variables. However, like (A), here also R2 is quite low in the case when percent changes in the variables are considered. This shows that percentage changes in the dependent variables are not well explained by the percentage variations in the independent variables. In the case of actual and log values, the independent variables are found to be statistically highly significant, but for percentage changes, the coefficient are not statistically significant. The elasticities of money supply (M1 or M3) with respect to Real Income (YR) turn out to be between 2. 6 and 3. 2 and these values are slightly more than double the elasticities obtained in the case of actual GDP. These values are also in conformity with the values obtained by Gujarati Damodar (1968) and Rangrajan C (1988). In the case of real M1 and real M3, the coefficient of WPI was negative and statistically significant when GDP is another independent variable indicating that a rise in the level of WPI lowers the real demand for money. This goes against the usual ' maintained hypothesis' that the real demand for money us homogeneous of degree zero (0) in price, as concluded by Gupta Suraj (1986) also. Autocorrelation was found to be present in all the cases. Thus it may be said that in all these models transformation of variables have not affected presence of autocorrelation.(C) The model outlined in (A) and (B) were again re-estimated using the real values of the relevant variables, [Equation 13 to 24 in Table 1. 2]In this case also the results are similar to the once obtained in (A) and (B). The only

difference is that autocorrelation was found to be absent when variables were measured in terms of percentage change, with the exception of the case in which the percentage change in GDP is the only independent variable. The values of elasticity of real M1 (and real M3) with respect to GDP is found to be almost half of the corresponding values in the case of actual M1 (and actual M3) and elasticity of real M1 (and real M3) with respect to real income also reduces to almost half of the corresponding values in the case of actual M1 (and actual M3). All the coefficients in all the equations were found to be statistically significant at 5 percent level.

Table 1. 1: Demand for Money in India OLS estimation 1950-51 to 2004-05

Eq.

Dependent

Constant

gdp

loggdp

pergdp

YR

logYR

perYR

R2

DW

Remark

1

M1

-4755. 71(-2. 7211)

**

0. 1964(97. 060)

**

0. 99430. 2491

P

2

Log M1

-0. 8346(-29. 4825)

**

1. 014(183. 44)

**

0. 99830. 455

P

3

Per M1

4. 8547(3. 2514)

**

0. 5853(4. 9397)

**

0. 30621. 7162

A

4

M3

-41851. 9(-3. 5766)

**

0. 6872(50. 7520)

**

0. 91950. 1119

P

5

Log M3

-1. 57183(-40. 7933)

**

1. 2199(162. 081)

**

0. 99790. 3155

P

6

Per M3

8. 40919(5. 9230)

**

0. 4755(4. 2206)

**

0. 24080. 8497

P

7

M1

-97670. 7(-10. 6673)

**

36. 373(25. 1553)

**

0. 92120. 1035

P

8

Log M1

-5. 3472(-33. 2503)

**

2. 6783(60. 1721)

**

0. 98530. 3134

P

9

Per M1

12. 0401(9. 9497)

**

-0. 1292(-0. 6574)0. 00820. 8787

P

10

M3

-35878. 8(-9. 1854)

**

125. 65(20. 3697)

**

0. 88450. 0790

P

11

Log M3

-6. 9731(-31. 2761)

**

3. 2138(52. 0799)

**

0. 98040. 1988

P

12

Per M3

13. 7289(12. 4305)

**

0. 00802(0. 0447)0. 000030. 3340

P

Figures in parenthesis are t-values ** Statistically significant at 5 percent level P: Presence of autocorrelation A: Absence of autocorrelation

Table 1. 2: Demand for Money in India OLS estimation 1950-51 to 2004-05

Eq.

Dependent

Constant

gdp

loggdp

pergdp

YR

logYR

perYR

R2

DW

Remark

13

real M1

428. 25(23. 9703)

**

0. 00010(49. 3472)

**

0. 97820. 0931

P

14

Logreal M1

0. 87745(17. 8895)

**

0. 3872(40. 4317)

**

0. 96800. 2348

P

15

Perreal M1

7. 6443(4. 6665)

**

-0. 3872(-1. 9355)

*

0. 04931. 2691

A

16

real M3

665. 009(11. 2809)

**

0. 00389(57. 0233)

**

0. 98360. 1430

P

17

Logreal M3

0. 1402(2. 9858)

**

0. 5926(64. 61)

**

0. 98720. 3613

P

18

Perreal M3

11. 1921(6. 4160)

**

-0. 3686(-2. 6625)

**

0. 10301. 0775

P

19

real M1

-96. 5626(-5. 3496)

**

0. 1972(69. 2084)

**

0. 98840. 2693

P

20

Logreal M1

-0. 9099(-17. 3396)

**

1. 0406(71. 6394)

**

0. 98950. 4696

P

21

Perreak M1

1. 9628(1. 9472)

*

0. 6209(3. 7907)

**

0. 20141. 9238

A

22

real M3

-1296. 72(-12. 2694)

**

0. 7444(44. 6052)

**

0. 97350. 1174

P

23

Logreal M3

-2. 5359(-29. 72)

**

1. 5761(66. 7568)

**

0. 98800. 2440

P

24

Perreal M3

3. 5172(3. 3119)

**

0. 7690(4. 4563)0. 26241. 6021

A

Figures in parenthesis are t-values ** Statistically significant at 5 percent level P: Presence of autocorrelation A: Absence of autocorrelation

II) The second set of estimated models involves a different set of macroeconomic variables as the independent variables; viz. WPI, Short Term Interest Rate (SIR) and their lagged values. The results using different combinations of these variables are depicted in Table 1. 3. [Equation 25 to 32] and Table 1. 4 [Equation 41 to 48]Here, instead of using the crude method of transforming the independent variables to get rid of autocorrelation problem as was done in the previous section, we have used a more sophisticated method viz. Cochrane-Orcutt (C-O method)[⊝]method to solve the problem of autocorrelation. Table 1. 3 A [Equation 33 to 40] and

Table 1. 4 A [Equation 49 to 56]The following broad conclusions are derived: In all the estimated models, the problems of autocorrelation remain. All the R2 values are above 0. 9; indicating extremely good fit. In the case of both real M1 and real M3, the coefficients of WPI were found to be statistical insignificant when real income replaced GDP as an independent variable. This may have happened due to the fact that real income had captured the influence of price factor to some extent. In the case of real M1 and real M3 the coefficients of the lagged values of WPI are insignificant, when real income is one the independent variables along with SIR. But when the real income variable is replaced by its lagged values in the case of real M1; all the coefficient are significant but in the case of real M3 lagged WPI is statistically insignificant.

Table 1. 3: Demand for Money in India OLS estimation 1950-51 to 2004-05

Eq.

Dependent

Constant

WPI

GDP

Sir

YR

WPI-1

GDP-1

YR-1

R2

DW

Remark

25

realM1

306. 225(20. 9426)

**

6. 5138(11. 2071)

**

0. 00055(12. 8180)

**

0. 99350. 4017

P

26

realM1

255. 391(9. 7571)

**

3. 0445(1. 8943)

*

0. 00077(7. 3629)

**

19. 1842(2. 3020)

**

0. 99400. 5181

P

27

realM1

-145. 82(-3. 5256)

**

-2. 4765(-1. 3216)0. 0324(8. 6837)

**

0. 98900. 3273

P

28

realM1

73. 4734(2. 2049)

**

2. 1576(1. 779)

*

-27. 4368(-9. 7750)

**

0. 1775(10. 5032)

**

0. 99600. 8183

P

29

realM1

251. 57(8. 6133)

**

0. 00079(7. 0790)

**

21. 3099(2. 5311)

**

2. 8612(1. 5967)0. 99380. 4846

P

30

realM1

248. 515(8. 6133)

**

19. 761(2. 2458)

**

3. 7987(2. 1246)

**

0. 00081(6. 5709)

**

0. 99330. 4462

P

31

realM1

44. 5486(1. 1959)-26. 0894(-9. 0931)

**

0. 1938(9. 9260)

**

1. 0246(0. 6998)0. 99580. 8647

P

32

realM1

76. 3188(2. 2384)

**

-25. 8087(-9. 0435)

**

3. 1768(2. 5731)

**

0. 1751(10. 0400)

**

0. 99590. 7797

P

Figures in parenthesis are t-values ** Statistically significant at 5 percent level P: Presence of autocorrelation A: Absence of autocorrelation

Table 1. 3. A : Demand for Money in India Cochrane-Orcutt estimation 1950-51 to 2004-05

Eq.

Dependent

Constant

WPI

GDP

Sir

YR

WPI-1

GDP-1

YR-1

R2

DW

Remark

33

realM1

1725. 13(3. 8234)

**

-4. 2181(-2. 2028)

**

0. 00103(11. 1917)

**

0. 99841. 8930

A

34

realM1

1631. 91(3. 9871)

**

-2. 8475(-1. 3189)0. 00095(8. 6489

**

-7. 8286(-1. 2513)0. 99841. 9348

A

35

realM1

-339. 279(-1. 5085)5. 1245(3. 2030)

**

0. 1651(7. 8463)

**

0. 99761. 5154

IC

36

realM1

-43. 6199(-0. 2558)6. 2745(3. 6166)-14. 7815(-1. 8850)

*

0. 1382(5. 5810)

**

0. 99761. 6194

IC

37

realM1

876. 057(4. 4187)

**

0. 00082(8. 5957)

**

-11. 8501(-2. 0399)

**

0. 7082(0. 3719)0. 99831. 9597

A

38

realM1

830. 317(4. 1797)

**

-8. 8703(-1. 4300)0. 64400. 31820. 00093(8. 0615)

**

0. 99821. 550

IC

39

realM1

-41. 514(-0. 2644)-10. 5262(-1. 2422)0. 1540(4. 5660)

**

4. 89103(1. 9458)

*

0. 99721. 5282

IC

40

realM1

94. 77810. 8566-21. 39(-3. 0853)

**

7. 9533(4. 9872)

**

0. 1205(5. 4514)

**

0. 99751. 3199

p

Figures in parenthesis are t-values ** Statistically significant at 5 percent level

P: Presence of autocorrelation A: Absence of autocorrelation IC: inconclusive

Table 1. 4: Demand for Money in India OLS estimation 1950-51 to 2004-05

Eq.

Dependent

Constant

WPI

GDP

Sir

YR

WPI-1

GDP-1

YR-1

R2

DW

Remark

41

realM3

388. 345(5. 3366)

**

14. 7687(5. 1057)

**

0. 00283(13. 1796)

**

0. 98890. 2367

P

42

realM3

413. 053(3. 0193)

**

16. 455(1. 9588)

*

0. 002725(4. 9398)

**

-9. 3245(-0. 2141)0. 98860. 2291

P

43

realM3

-1753. 94(-7. 4334)

**

-22. 9836(-2. 1501)

**

1. 0709(7. 0132)

**

0. 97520. 1885

P

44

realM3

-423. 584(-2. 5649)

**

5. 1287(0. 8533)-166. 44(-11. 965)

**

0. 7379(8. 8078)

**

0. 99330. 4947

P

45

realM3

419. 406(2. 9885)

**

0. 00266(4. 5696)

**

-9. 9079(-0. 2275)

**

18. 1945(1. 9623)

*

0. 98850. 1987

P

46

realM3

357. 944(2. 5792)

**

7. 00562(0. 1655)16. 4612(1. 9141)

*

0. 0030(5. 1316)

**

0. 98940. 1981

P

47

realM3

-510. 812(-2. 8190)

**

-162. 973(11. 677)

**

0. 7889(8. 3055)

**

1. 5070(0. 2116)0. 99320. 5354

P

48

realM3

-444. 107(-2. 8982)

**

-160. 249(-12. 494)

**

7. 6585(1. 3802)0. 7499(9. 5659)

**

0. 99420. 4984

P

Figures in parenthesis are t-values ** Statistically significant at 5 percent level P: Presence of autocorrelation A: Absence of autocorrelation

Table 1. 4. A : Demand for Money in India Cochrane-Orcutt estimation 1950-51 to 2004-05

Eq.

Dependent

Constant

WPI

GDP

Sir

YR

WPI-1

GDP-1

YR-1

R2

DW

Remark

49

realM3

8273. 09(3. 4635)

**

-24. 3416(-3. 1657)

**

0. 00426(11. 5810)

**

0. 99830. 9522

P

50

realM3

7308. 6(4. 2860)

**

-8. 0134(-1. 0723)0. 003326(8. 7258)

**

-94. 7897(-4. 4143)0. 99871. 1797

P

51

realM3

-2410. 72(-2. 7367)

**

15. 2365(2. 3849)

**

0. 6890(8. 1928)

**

0. 99740. 8067

P

52

realM3

-475. 641(0. 7612)26. 304(4. 2968)

**

-119. 793(-4. 3265)

**

0. 4771(5. 4559)

**

0. 99801. 1398

P

53

realM3

4818. 76(3. 6057)

**

0. 002782(8. 4495)

**

-108. 801(-5. 5089)

**

5. 2790(0. 7755)0. 99871. 2481

P

54

realM3

4827. 59(3. 9782)

**

-91. 9813(-5. 0888)

**

0. 1471(0. 0237)0. 003470(10. 1368)

**

0. 99891. 2904

P

55

realM3

-488. 645(-0. 7283)-103. 875(-3. 4486)

**

0. 4936(4. 1522)

**

25. 3545(2. 8751)

**

0. 99771. 1492

P

56

realM3

-383. 104(-0. 6423)-127. 426(-5. 6403)

**

31. 6016(6. 0904)

**

0. 4597(6. 4813)

**

0. 99841. 0641

p

Figures in parenthesis are t-values ** Statistically significant at 5 percent level P: Presence of autocorrelation A: Absence of autocorrelation

Short term interest rate (Sir) is found to be statistically significant in all the

equations for real M1 but it is found to be statistically insignificant in 4 out of

6 cases for real M3. Thus, one may conclude that short term interest rate is

an important variable explaining variation in money supply, more so in the

case of narrow money. It can be noted here that earlier studies have obtained contradictory results regarding the impact of Sir on M1 and M3. Shastri (1962), Gupta (1969), Sharma (1987), Ramchandra U (1989) have concluded that demand for money in India is interest elastic, whereas Balbir Singh (1970), Gupat Suraj (1975), Sampat and Hussain (1981) and Ghatak (1981) have found that demand for money in interest inelastic. When the re-estimation of the change models was done using the Cochrane-Orcutt method, only 1 out of 8 cases, the problem of autocorrelation persisted in the case of real M1. However, in the case of real M3, in all the cases the problem of autocorrelation persisted. Thus, the problem of autocorrelation seems to be more serious in the case of real broad money. Use of the Cochrane-Orcutt method lead to insignificance of Short term interest rate variable in as many as 3 out of 6 cases, in the case of real M1, but this happened in only 1 case for real M3. For WPI, the results were more or less similar in the cases of real M1 and real M3, when Cochrane-Orcutt method was used for re-estimation. We have also attempted to estimate the models when log transformations of the real M3 and M1 are used as the dependent variables and log real income and short term interest rate are taken as the independent variables. Here we have also introduced the lagged dependent variables as the independent variable in some cases. Our conclusions are as follows: [Table 1. 5 Equations 57 to 60]Introduction of lagged dependent variable in the model not only improves R2 but also gets rid of the autocorrelation problem. This happens in the case of both M1 and M3. Short term interest rate [Sir] is found to be statistically significant in the case of M1 but not in the case of M3. This confirms our earlier conclusion also. Bhole

(1985) has also estimated money demand function separately for M1 and M3 using the liner form and taking income, interest rate, expected inflation rate and lagged money stock as the independent variables, and had concluded that generally all these explanatory variables were important variables determining nominal and real income stock.

Table 1. 5: OLS estimates: Demand for Money in India: 1950-51 to 2004-05

Eq. No

Dependent

Constant

Logyr

Sir

Lag dependent

R2

DW

Reference

57

Logrealm1
-1. 08215(-19. 9107)

**

1. 1053(64. 0367)

**

-0. 0091(-5. 1836)

**

0. 9930. 812

P

58

Logrealm1

-0. 50361(-5. 1686)

**

0. 4709(4. 8452)

**

-0. 0035(-2. 4270)

**

0. 5921(6. 6009)

**

0. 9961. 696

A

59

Logrealm3

-2. 5280(-23. 2398)

**

1. 5731(45. 5336)

**

0. 00041(0. 1183)0. 9870. 243

P

60

Logrealm3

-0. 4134(-2. 6843)

**

0. 2385(2. 5603)

**

0. 00016(0. 1062)0. 8655(14. 5436)

**

0. 9971. 479

IC

Figures in parenthesis are t-values DW = Durbin-Watson statistics*

Significant at 5 % level** Significant at 1% levelP = Presence of

autocorrelationA = Absence of autocorrelationIC = InconclusiveNote: Real

M1 and M3 measure as M1 / WPI and M3 / WPI respectively

Conclusion:

In order to determine the relationship between Money supply (M1 and M3) and other important macro economic variables like GDP, real income [YR], WPI and Short term interest rate [Sir], we have fitted several equations involving various combinations of these explanatory variables. In the first set of equations, M1 (M3), Log M1 (Log M3) and percentage change in M1 (M3) were taken as the dependent variable separately. These dependent variables were regressed on (i) GDP(ii) Log GDP and (iii) Percentage change in GDP respectively. Out of the 3 versions (absolute value, log and percentage change) in two versions viz. absolute and log form, the value of R2 is very high for both M1 and M3 indicating a good fit. However, the model incorporating the percentage change of variables had quite low R2 – around 0. 25. This shows that perhaps the percentage change in GDP is not an important determinant of percentage change in money supply (both M1 and M3). Our results also support the conclusions of Trivedi M S (1980), who used ' adaptive expectation hypothesis' to derive ' permanent income' which he used as the independent variable that the orthodox quantity theory gave quite satisfactory results. The elasticity of Broad Money (M3) with respect to GDP is higher (1. 22) than that of Narrow Money (M1) with respect to GDP (1. 01), as obtained in the log version. These values also indicate almost equiproportional change in the dependent and the independent variables. It is noteworthy here that Mishra G D (1985) who used the Random Coefficient Method (RCM) for estimating the equation also found that the values of income elasticity was 1. 0528 as against 1. 0176 for OLS. Thus our results are also in conformity with the values obtained earlier by him. We have

estimated same set of equations replacing GDP by Real Income (YR). It was found thatthe value of R2 was quite high (around 0. 98) in the case of the actual values and the log values ofthe variables. However, here also R2 is quite low in the case when percent changes in the variables are considered. This shows that percentage changes in the dependent variables are not well explained by the percentage variations in the independent variables. The elasticities of money supply (M1 or M3) with respect to Real Income (YR) turn out to be between 2. 6 and 3. 2 and these values are slightly more than double the elasticities obtained in the case of actual GDP. These values are also in conformity with the values obtained by Gujarati Damodar (1968) and Rangrajan C (1988). In the case of real M1 and real M3, the coefficient of WPI was negative and statistically significant when GDP is another independent variable indicating that a rise in the level of WPI lowers the real demand for money. This goes against the usual ' maintained hypothesis' that the real demand for money us homogeneous of degree zero (0) in price, as concluded by Gupta Suraj (1986). Autocorrelation was found to be present in all the cases. Thus it may be said that in all these models transformation of variables have not affected presence of autocorrelation. The second set of estimated models involves a different set of macroeconomic variables as the independent variables; viz. WPI, Short term interest rate (Sir) and their lagged values. Here, instead of using the crude method of transforming the independent variables to get rid of autocorrelation problem as was done in the first set of equations, we have used a more sophisticated method viz. Cochrane-Orcutt (C-O method) method to solve the problem of autocorrelation. The following broad conclusions are derived: In all the

estimated models, the problems of autocorrelation remain. All the R2 values are above 0. 9; indicating extremely good fit. In the case of both real M1 and real M3, the coefficients of WPI were found to be statistical insignificant when real income replaced GDP as an independent variable. This may have happened due to the fact that real income had captured the influence of price factor to some extent. In the case of real M1 and real M3 the coefficients of the lagged values of WPI are insignificant, when real income is one the independent variables along with SIR. But when the real income variable is replaced by its lagged values in the case of real M1; all the coefficient are significant but in the case of real M3 lagged WPI is statistically insignificant. Short term interest rate (Sir) is found to be statistically significant in all the equations for real M1 but it is found to be statistically insignificant in 4 out of 6 cases for real M3. Thus, one may conclude that short term interest rate is an important variable explaining variation in money supply, more so in the case of narrow money. It can be noted here that earlier studies have obtained contradictory results regarding the impact of Sir on M1 and M3. Shastri (1962), Gupta (1969), Sharma (1987), Ramchandra U (1989) have concluded that demand for money in India is interest elastic, whereas Balbir Singh (1970), Gupat Suraj (1975), Sampat and Hussain (1981) and Ghatak (1981) have found that demand for money in interest inelastic. When the re-estimation of the change models was done using the Cochrane-Orcutt method, only 1 out of 8 cases, the problem of autocorrelation persisted in the case of real M1. However, in the case of real M3, in all the cases the problem of autocorrelation persisted. Thus, the problem of autocorrelation seems to be more serious in the case of real

broad money. We have also attempted to estimate the models when log transformations of the real M3 and M1 are used as the dependent variables and log real income and short term interest rate are taken as the independent variables. Here we have also introduced the lagged dependent variables as the independent variable in some cases. Introduction of lagged dependent variable in the model not only improves R2 but also gets rid of the autocorrelation problem. This happens in the case of both M1 and M3. Short term interest rate [Sir] is found to be statistically significant in the case of M1 but not in the case of M3. This confirms our earlier conclusion also. Bhole (1985) has also estimated money demand function separately for M1 and M3 using the liner form and taking income, interest rate, expected inflation rate and lagged money stock as the independent variables, and had concluded that generally all these explanatory variables were important variables determining nominal and real income stock.