AN ANALYSIS OF MONEY DEMAND IN PAKISTAN

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ABSTRACT

This study re-examines the nature of money demand in Pakistan, using 1972 to 1996 quarterly data. The results indicate that it is the inflation rate rather than interest rate that could paged in order to stabilize money demand. This conclusion is reinforced by the observation that with the changed composition of money following the financial reforms in 1990s has made money demand most sensitive to inflation rate. The results also show that money demand is authority in adjusting high powered money to track money market equilibrium. The study also concludes that in the short-run money demand is not too sensitive to shocks and in order to make the realize outcomes consistent with the targets, the monetary authority need to take the speed of adjustment in money demand into account.

1. INTRODUCTION

In adopting an effective monetary policy, it is essential to understand the characteristics of money market, especially the money demand function. Without reliable estimates of money demand function, an optimal monetary policy cannot be formulated. In Pakistan monetary policy has not been formulated in the light of expected money demand. For instance, expansions in high-powered money and bank credit have been determined by the government's borrowing need for budgetary support. Although a number of studies have been conducted on demand for money in Pakistan, the monetary authorities have not properly utilised the information.

Some of the issues that have been focussed in the literature on money demand in Pakistan are as follows. Should the demand for money be measured in nominal or real terms? Should income or wealth or perhaps both be included in the money demand function? Is interest rate an important variable in the function? What influence does the rate of inflation exert on the demand for money? Are there any significant economies of scale in holding of money balances? How quickly does money market adjust to disequilibrium forces? Since during the past two decades or so the financial sector has seen a variety of new trends and innovations, it is also essential for designing reliable monetary policies to update knowledge on the basis of latest data. This is one of the reasons why similar studies on money demand have appeared in the literature quite often.

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It is in this spirit that we set our primary objective in this study to update our knowledge on the nature of money demand in Pakistan. For the purpose of a thorough understanding, we shall estimate a variety of money demand functions that have been estimated in different studies. A comparison of these demand functions estimated on a given set of data is likely to provide useful information from the purpose of policy making. Another aspect that has not been properly addressed in the literature is the long run validity of an estimated money demand function. Only Ali (1994), Hossain (1994) and Khan (1994) have applied co-integration tests. However, the results in Ali (1994) and Hossain (1994) cannot be taken seriously as the two studies use only 20 and 21 observations respectively. As is well known, a proper co-integration test requires a long time series. In the light of this requirement, the present study uses 96 quarterly observations to have a sufficiently large sample size in order to apply co-integration tests on a number of specifications for money demand function.

In addition to the above objectives, the paper also aims to study the effects of reforms in the financial sector of Pakistan in early 1990s on money demand. In particular, we shall test whether or not the reforms have resulted in a structural shift in money demand function. Such an analysis is quite relevant because if it becomes known that the structural shift has taken place then a new approach towards monetary policy may be desirable. Thus we aim to re-examine a number of issues relating to money demand using the updated information and non-conventional techniques in econometrics such as AR/MA specification for regression errors and tests of co-integration.

The paper is planned as follows. In Section 2 we provide a survey of literature on the empirical work on money demand in Pakistan. In Section 3 we develop our methodology. Data and estimation procedure are discussed in Section 4. The empirical findings are presented and discussed in Section 5. Section 6 concludes the study.

2. REVIEW OF LITERATURE

Estimation of money demand function is an extensively explored area in empirical research. The practice of estimating money demand function gained popularity during mid-1970s (e.g; Akhtar 1974 and Abe et al. *1975)* when Pakistan for the first time experienced high rates of inflation that necessitated major changes in the interest rates as well. However, the first major study on

the subject was done by Mangla (1979). Since the study was based on a small sample of 14 annual observations, some of the results were contrary to economic theory. The author, therefore, recommended in favour of using quarterly data for the study of money demand functions.

In a similar study Khan (1980) used a larger sample of annual observations over the period 1959-60 to 1977-78. The study introduced the effect of inflation and monetization on money demand and also tested the stability of money demand function. The author found no significant difference in the results while using permanent or measured income alternatively and claimed that this is due to very low per capita income and an agro-based economy, which makes current income an effective binding factor in the money demand function. The study observed insignificant effect of inflation in the period before 1971 and a significant effect for the latter period when the inflation rate was much higher. Using the same data period, Khan (1981) adopted a disaggregated approach to estimate the demand for various components of money and obtained similar results by the disaggregated approach as with the aggregated approach.

With almost the same data period, Nasir and Naheed (1983) used term structure of interest rates in money demand function. The authors used term structure of interest rates, represented by the intercept and slope of the yield curve. The study found the presence of diseconomies of scale in the use of money. In another study, Saqib and Maqsood (1986) estimated money demand and money supply functions. Most of the estimated parameters, based on OLS and 2SLS techniques, were statistically significant and had expected algebraic signs.

Using monthly data over the period 1975 to 1989, Cornelisse (1989) estimated money demand and money supply functions. To estimate monthly GDP, the author divided the annual GDP data into 12 parts and then added the dummy variable in the equation. The author also
estimated the function on annual data, but the results were more significant with monthly data. Both the narrow and broad definitions of money (M1 and M2) were used in the analysis, though the results with broad definition were more precise than with the narrow definition.

Hossain (1994) performed co-integration analysis on money demand function over the period 1951 to 1991 and 1972 to 1991. The study did not find a

significant relationship between money demand measured by broad definition (M2) and real output and it could not establish a co-integrating relationship of the narrow or broad money balances with interest rate. In a similar study Ali (1994) also applied co-integration technique to money demand function using annual data from the period 1972-73 to 1992-93. The author concluded that narrow monetary aggregate is unstable and unpredictable in the long-run while the broad monetary aggregate exhibits stable long-run relationship with income, real interest rate and inflation rate. The study concluded that for policy making the authorities should target M2, rather than MI, definition of money.

Khan (1994) applied co-integration analysis on money demand function with quarterly data from 1971.3 to1993.2. The author found that M2 co-integrated with both nominal and real income and medium term interest rate, but not with the short-term interest rate and inflation rate. On the other hand, MI was found to be co-integrated with real income, real interest rate and inflation rate, but not with short-term and medium-term nominal interest rates. The study also observed that financial liberalisation in early 1990s did not have a major destabilising effect.

As is obvious from the above discussion, the results of various studies differ quite substantially from one another. One of the reasons for this disagreement is that many studies were based on small samples of annual observations. But a more plausible explanation is that the authors have used different models and different data sets to reach different conclusions. Thus there is a need to perform a thorough analysis of money demand, estimating a variety of models using a given data set that has sufficiently large number of observations.

3. SPECIFICATION OF MONEY DEMAND FUNCTIONS

The conventional money demand function received extensive theoretical and empirical treatment in the literature in developing as well as developed countries. We first consider the conventional form of money demand function, which can be written as

$$\log(M^*t) = a_0 + a_i \log(P_t Y_t) + a2\, R_1 \qquad (1)$$

where M* is the desired money balances measured in nominal terms, Y is a scale variable, such as GNP or GDP, and R represents the opportunity cost of holding money.

We now allow the possibility that in the short run, economic agents may not be able to adjust money balances at the desired level due to uncertainty and transaction cost that they have to pay in order to change their portfolio of assets. Thus we introduce partial adjustment model:

$$\log(M_t) - \log(M_{t-1}) = \lambda\,[\log(M^*_t) - \log(M_{t-1})],\ 0 < \lambda < 1 \qquad (2)$$

where λ is the adjustment coefficient. Now substituting for $\log(M^*_t)$ from equation (1), we have:

$$\log(M_t) = \lambda\, a_0 + \lambda\, a_1 \log(P_t Y_t) + \lambda\, a_2 R_t + (1 - \lambda) \log(M_{t-1}) \qquad (3)$$

We shall also estimate the money demand function by splitting nominal income $\log(P_t Y_t)$ into price variable $\log(P_t)$ and real income variable $\log(Y_t)$. The purpose of this splitting is to determine whether money demand is more sensitive to change in price level or real income. Thus equation (3) can be rewritten as

$$\log(M_t) = \lambda\, a_0 + \lambda\, a_1 \log(P_t) + \lambda\, b_1 \log(Y_t) + \lambda\, a_2 R_t + (1 - \lambda) \log(M_{t-1}) \qquad (4)$$

In addition to the money demand function in nominal form, we shall estimate the demand function for real money balances. Thus following the procedure for the nominal money demand function (equation 3), we have the following demand function for the real monetary balances.

$$\log(M_t/P_t) = b_0 + b_1 \log(Y_t) + b_3 R_t + (1 - \lambda) \log(M_{t-1}/P_{t-1}) \qquad (5)$$

If nominal money demand does not have unit elasticity with respect to price level, as could be expected, then the above equation will be generalised as follows.

$$\log(M_t/P_t) = b_0 + b_1 \log(Y_t) + b_2 \log(P_t) + b_3 R_t + (1-\lambda) \log(M_{t-1}/P_{t-1}) \qquad (6)$$

An estimated money demand function that is stable over time is quite useful for policy makers. We check the stability of money demand with respect to liberalisation in monetary sector that occurred in 1991, which allowed the residents of Pakistan to keep foreign currency accounts. The stability test is applied to the conventional money demand function in both nominal and real terms. Thus we include in equations (3) and *(5)* a dummy variable, denoted Z, both additive and interactive forms, that takes the value one if an observations belongs to the period after the financial reforms (February 1992) and zero otherwise. That is,

$$\log(Mt) = a_0 + a_1 \log(P_t Y_t) + a_2 R_t + a_3 \log(M_{t-1}) + b_0 Z_t + b_1 Z_t \log(P_t Y_t) + b_2 Z_t R_t + b_3 Z_t \log(M_{t-1}) \quad (7)$$

$$\log(M_t/P_t) = a_0 + a_1 \log(Y_t) + a_2 R_t + a_3 \log(M_{t-1}/P_{t-1}) + b_0 Z_t + b_1 Z_t \log(Y_t) + b_2 Z_t R_t + b_3 Z_t \log(M_{t-1}/P_{t-1}) \quad (8)$$

4. DATA AND ESTIMATION PROCEDURE

Following some earlier attempts, we shall use quarterly data in order to increase degree of freedom. An additional advantage by using the quarterly data is that one can capture seasonal pattern of money demand that provides additional information on the nature of money demand. The study covers the period 1972.11 to 1996.1. We use both narrow (M1) and broad (M2) definitions of money alternatively as the dependent variable because in the empirical studies on demand for money, the choice between (M1) and (M2) is ambiguous.

The choice between current and permanent incomes to represent the scale variable is controversial. Mangla (1979), for example, suggests the use of permanent income. But Khan (1980) argues in favour of measured income for Pakistan because it has an agro-based economic structure and very low per capita income, which becomes an effective constraint on intertemporal allocation. Furthermore, given the high rate of inflation in Pakistan, current income would be a better choice since it places greater emphasis on transaction demand for money while the permanent income would place greater emphasis on asset portfolio behaviour. For these reasons we have decided to use current income in our study.

We cannot use GDP on which no quarterly information is available. A crude approximation would be based on interpolated quarterly GDP. We shall rather use the index of industrial production, on which quarterly data are available, with the argument that money demand activities are linked quite closely to this sector. Following Khan's (1980) argument discussed above, we use current output rather than its permanent counterpart as a scale variable.[1]

The importance of interest rate in money demand has been firmly established. The literature is, however, not in agreement as to which interest rate should be used as the opportunity cost of holding money, e.g. long-term or short-term (e.g., Bronfer 1960, Brunner and Meltzer 1964, Heller 1965 and Laidler 1977). According to Wong (1977) most people in developing country live near subsistence level and hold money for precautionary purpose over shorter periods. This means that short term interest rate is more appropriate in case of Pakistan.

In developing countries money market is not well developed and interest rates are not determined by free market forces, but are controlled by authorities. Therefore, it might also make sense to use inflation rate as a proxy for the opportunity cost of holding money. In this study we shall alternatively use inter bank call money rate, which is considered the basis for most of the short-term interest rates, and inflation rate as opportunity cost of holding money. It is important to note that the average rate of inflation in Pakistan has been in the double digits for the most of the period of analysis. For the inflation rate, we use consumer price index (CPI). We convert all the price indices on the same base year that is 1990. Data on all the variables are taken from two sources, namely International Financial Statistics and Bulletin, State Bank of Pakistan.

Our estimation procedure follows a number of steps. First of all the specified equations are estimated by OLS technique and are examined to detect autocorrelation. Since we use quarterly data, conventional tests such as Durbin Watson or Durbin-h tests are not suitable as both these tests consider first order autocorrelation only. Therefore we use the OLS estimates to derive regression residuals and plot correlagrams with 24 lag length, which indicate the size of simple and partial autocorrelation coefficients at length one to 24. The associated Q-statistics will provide information on the significance of cumulative correlation coefficients from order one upto 24. From the observed

[1]Khan (1981) has used non-agricultural income as a scale variable in the demand function for bank deposits.

pattern of peaks in autocorrelation functions (ACF) and partial autocorrelation function (PACF), we can identify lag lengths in the autoregressive moving average (ARMA) models. After incorporating the identified ARMA terms in the corresponding regression equations, the latter are re-estimated. Again the correlagrams for the regression residuals are examined to make further improvement in the ARMA specification. This procedure is repeated until Q-statistics for all lag length (one to 24) become insignificant and therefore regression residuals are white noise.

At the last step, the regression equations are examined for co-integration. Confirmation of co-integrating relationship is essential to ensure that the results of estimation hold for the long run and they are not spurious. Three conditions must be satisfied for co-integration. These are: a) sample size is sufficiently large, b) all the variables in the equation are non-stationary but integrated of the same order, and c) the regression residuals forming linear combination of the variables are integrated of an order less than the order of integration of the individual variables.[2]

5. THE RESULTS

We first present the results for money demand function when the quantity of money is measured in nominal terms. These results, presented in Table 1, show that the overall explanatory power of the model is high. The values of DW and Q statistics for various lag lengths (the latter are not reported in the paper) show that autocorrelation has been removed by the MA(4) (fourth order moving average) term for the regression residuals. The MA(4) process indicates the presence of strong seasonality in money demand.

The signs of all the regression coefficients are consistent with economic theory and most of these are statistically significant. Positive elasticity of money demand with respect to income means that money demand for transaction purpose increases when income increases. Theoretically, there is negative relationship between money demand and interest rate. The same behaviour appears from the estimated money demand function. The value of interest rate coefficient is low but statistically significant. However, when we replace interest rate by inflation rate, the coefficient of opportunity cost variable becomes larger and significant at a higher level of confidence. Thus a high rate of inflation is a stronger incentive to economise on monetary

[2]See Enders (1995)

balances than the incentive provided by a higher interest rate. The coefficient of lagged money demand is statistically significant and close to one, suggesting that agents mostly follow previous trend and demand for narrow money adjust towards the desired level quite slowly.

Table –1: Demand Functions for Nominal Monetary Balances

Dependent Variable	Narrow Money	Narrow Money	Broad Money	Broad Money
Intercept	0.686 (4.628*)	0.621 (4.62*)	0.582 (4,37*)	0.58 (4.79*)
Nominal value of Out put	0.088 (4.23*)	0.078 (4.06*)	0.072 (4.04*)	0.068 (4.15*)
Inter Bank Call Money Rate	-0.318 (-1.93**)		-0.054 (-1.378)	
Inflation rate		-0.438 (-3.72)		-0.366 (-3.321*)
Lagged Dependent Variable	0.894 (36.70*)	0.905 (40.01*)	0.914 (43.914*)	0.916 (47.37*)
MA(4)	0.278 (2.69*)	0.277 (2.645*)		
R^2	0.999	0.999	0.999	0.999
D.W	1.65	1.92	1.79	2.07
F Statistics	28816.17	31912.26	43530.01	48676.0

Note: * and ** indicate significant at 5% and 10% levels respectively.

The results with the broad money (M2) are similar to the results for the narrow money, except that the broad money is somewhat less elastic to changes in income and interest rate (or inflation rate) then the narrow money. The interest rate sensitivity of broad money demand is not only low but also statistically insignificant. This means that as compared to the demand for narrow money balances, the demand for broad money is less sensitive to its determinants. Since the broad money also includes such deposits that are relatively less liquid as compared to the narrow money, this result means that the less liquid forms of money are relatively less elastic to changes in income and interest rate or inflation rate.

The coefficient of lag dependent in the demand function for broad money is larger than in the case of Ml. Thus the board money adjusts slower towards the desired level than the narrow money. This result follows from the fact that the broad money also includes less liquid assets and therefore it would take a longer time period to realise the desired changes in money holding.

Table 2 shows the results of estimated money demand functions when we split the nominal output into real output and price level. The results are again satisfactory in term of overall explanatory power of models. Autocorrelation has been removed by the MA(4) term only for narrow money. The DW statistic lies in the acceptable range and Q-statistics for various lag lengths (not reported in the paper) are also insignificant.

The results show that demand for money is more sensitive to change in the price level than to the change in real output. That is the general price level is a more important factor than the real output in determining the money demand. This result is quite robust because it holds for both the Ml and M2 definitions of money and for each of the opportunity cost of holding money, that is inter bank call money rate and inflation rate. The estimates of the other parameters and their statistical significance are more or less the same as in Table 1. The coefficients of lagged dependent variable are very large but smaller as compared to those in Table 1. This again means that money demand adjusts quite sluggishly towards the desired level.

Table 2: Demand Functions for Nominal Monetary Balances (Splitting Nominal Output between Real Output and Price Level)

Dependent Variable	Narrow Money	Narrow Money	Broad Money	Broad Money
Intercept	0.87 (3.913*)	0.715 (3.954*)	1.011 (4.56*)	0.926 (5.478*)
Real output	0.076 (3.316*)	0.069 (3.15*)	0.061 (3.388*)	0.053 (3.127*)
Customer Price Index	0.127 (3.115*)	0.099 (2.971*)	0.154 (3.989*)	0.140 (4.695*)
Inter Bank Call Money Rate	-0.430 (-2.249)		-0.292 (-1.712**)	
Inflation Rate		-0.459 (-3.793*)		-0.448 (-4.069*)
Lagged Dependent	0.872 (27.504*)	0.893 (33.031*)	0.861 (28.626*)	0.87 (36.29p*)
MA(4)	0.295 (2.831*)	0.291 (2.75*)		
R^2	0.999	0.999	0.999	0.999
D.W	1.688	1.932	1.831	2.2
F Statistics	23126.21	25429.68	34315.49	39297.52

Note: *and** indicate significant at 5% and 10% levels respectively.

We now estimate money demand function in real terms. The results are arranged in Table 3. For the real money balances we use real output as a scale variable with inter bank call money rate or inflation rate as an opportunity cost of holding money. The overall explanatory power of the model is again high and the autocorrelation problem is not evident. The regression coefficients possess the anticipated signs, indicating that the results are consistent with economic theory.

As before we find that money demand is more sensitive to inflation rate than to inter-bank call money rate, though the regression coefficients of both the variables are significantly different from zero. In all the estimated equations the coefficients of lagged dependent variables are significantly different from one but smaller than the corresponding coefficients in the demand function for nominal money (see Table 1). This means that the speed

of adjustment towards the desired real money balances is faster than the speed of adjustment towards the nominal money balances (see Table 1 for comparison). It follows therefore that the relatively faster adjustment in real money balances towards the desired level is partially accomplished by changes in price level. For example if the observed money balances exceed the desired level, not only would the nominal holding of money adjust downward in the subsequent periods, but also the price level will rise to reduce, only partially, the real balances towards the desired level.

Table 3: Demand Functions for the Real Monetary Balances

Dependent Variable	Narrow Money	Narrow Money	Broad Money	Broad Money
Intercept	1.804 (6.301*)	0.912 (4.919*)	1.677 (5.747*)	0.828 (5.537*)
Real output	0.18 (7.5*)	0.08 (4.434*)	0.153 (6.58*)	0.064 (4.5*)
Inter Bank Call Money Rate	-0.643 (-2.413*)		-0.538 (-2.126*)	
Inflation Rate		-1.333 (-11.304*)		-1.303 (-12.034*)
Lagged Dependent Variable	0.715 (17.341*)	0.862 (30.163*)	0.752 (18.762)	0.885 (39.662*)
MA(1)	0.421 (3.774*)		0.356 (3.340*)	
MA(2)	0.330 (2.835*)	0.229 (2.052*)	0.277 (2.508*)	
MA(4)		0.318 (3.044*)		
R^2	0.986	0.993	0.987	0.994
D.W	1.925	1.876	1.98	2.16
F Statistics	1288.67	2531.68	1361.76	4903.99

Note * and ** indicate significant at 5% and 10% levels respectively.

Also notice that in the demand functions for the narrow money includes significant MA(4) and MA(l) or MA(2) terms. Thus strong dynamics are present in the money demand function. On the other hand, no MA (4) term is used in the equations for M2. That is seasonality is not present in the real demand for broad money. Furthermore when we take inflation rate as an opportunity cost of holding broad money, no MA term is used to remove autocorrelation.

Table 4 reports the results for both the narrow and broad money in real terms when we introduced the effect of general price level on demand for the real money balances. The results are again satisfactory with all the regression coefficients having expected algebraic signs. A notable result here is that demand for real money balances is not affected by general price level. The reason is that the real money balances are already discounted for inflation. This means that there is no apparent evidence of money illusion in the money demand function.

We will now examine stability of the money demand function both in nominal and real terms. The results with nominal money demand (equation 7) are reported in Table *5*, while those with the real money (equation 8) are given in Table 6.

We can see from the results for the intercepts and most of the slope coefficients in the money demand function are stable over the two time periods, viz, before 1992 and after 1992. Only the effect of inflation on money demand (narrow as well as broad) has increased in the period after financial reforms (that is the first quarter of 1992). However the F-statistic measuring the significance of the incremental effects due to structural shift is significant only in case of broad money when inflation rate is used as an opportunity cost of holding money. We can, therefore conclude that except for the effects of inflation, the money demand functions are stable between the pre and post reform periods.

Table 4: Demand Functions for the Real Monetary Balances (Including Price Level as a Determinant of Money Demand)

Dependent Variable	Narrow Money	Narrow Money	Broad Money	Broad Money
Intercept	1.615 (4.053*)	0.844 (4.032*)	1.90 (3.57*)	0.626 (5.478*)
Real output	0.188 (7.466*)	0.091 (4.19*)	0.14 (5.028*)	0.053 (3.127*)
Inter Bank Call Money Rate	-0.018 (-0.0724)	-.0.012 (-0.767)	0.023 (0.81)	0.013 (1.23)
Inflation Rate		-1.320 (-11.01*)		-1.321 (-12.12*)
Lagged Dependent Variable	0.740 (13.296*)	0.87 (28.26*)	0.73 (10.11*)	0.87 (36.29*)
MA(1)	0.405 (3.574*)			
MA(2)	0.332 (2.885*)	0.24 (2.11*)		
MA(4)		0.329 (2.74*)		
AR(1)			0.39 (3.066*)	
R^2	0.986	0.993	0.987	0.994
D.W	1.920	1.86	2.06	2.2
F Statistics	1668.260	2099.09	1309.8	3698.96

Note: * and ** indicate significant at 5% and 10% levels respectively.

The demand for money has become more sensitive to inflation rate because after the reforms agents have more options to invest their assets that could either protect the value of assets from inflation or yield better returns. For example a new alternative to holding money appeared in the form of foreign currency accounts that are at least partially indexed for inflation. Even small asset holders can hedge against inflation by investing in these accounts. Another alternative that was available in the past but was not much developed has been to invest in stock market. During earlier periods of development

following the financial reforms, the returns on investment in stock markets were high enough to compensate both for inflation and the risk of market volatility.

Table 5: Stability of the Demand Functions for Nominal Monetary Balances

Dependent Variable	Narrow Money	Narrow Money	Broad Money	Broad Money
Intercept	0.638 (3.8*)	0.571 (4.11*)	0.642 (4.035*)	0.647 (4.94*)
Nominal Output	0.082 (3.67*)	0.072 (3.67*)	0.076 (3.86*)	0.071 (4.14*)
Inter Bank Call Money Rate	-0.317 (-1.44)		-0.093 (-0.479)	
Inflation Rate		-0.511 (-4.23*)		-0.469 (-4.2*)
Lagged Dependent Variable	0.902 (33.84*)	0.912 (39.26*)	0.907 (38.32*)	0.909 (44.36*)
Z	-1.36 (-1.1)	-0.71 (-0.71)	-0.036 (-0.043)	0.002 (0.003)
Z (Nominal output)	0.046 (0.78)	0.018 (0.39)	-0.005 (-0.093)	-0.22 (-0.48)
Z (IBCR)	-0.002 (-0.49)		-0.001 (-0.22)	
Z (Inflation rate)		1.34 (2.63*)		1.32 (2.81*)
Z(Lagged dependent Variable)	0.068 (0.66)	0.039 (0.41)	0.007 (0.096)	0.013 (0.19)
MA(4)	0.25 (2.29*)	0.2 (1.74**)		
R^2	0.999	0.999	0.999	0.999
D.W.	1.78	1.81	1.79	2.01
F Statistics	14182.09	16795.12	18068.06	22285.28
Incremental F-statistics	0.643	2.16	1.20	3.42*

Z is a dummy variable that is set equal to zero for the period prior to the first quarter of 1992 and one afterwards.
Note. *and ** indicate significant at 5% and 10% levels respectively.

Table 6: Stability of the Demand Functions for Real Monetary Balances

Dependent Variable	Narrow Money	Narrow Money	Broad Money	Broad Money
Intercept	1.92 (5.38*)	0.673 (3.99*)	2.15 (5.80*)	0.92 (5.92*)
Real Output	0.193 (7.10*)	0.06 (3.39*)	0.18 (7.05*)	0.064 (4.42*)
Inter Bank Call Money Rate	-0.764 (-1.92**)		-0.869 (-2.28*)	
Inflation Rate		-1.433 (-11.85*)		-1.400 (-12.83*)
Lagged Dependent Variable	0.70 (14.12*)	0.9 (34.03*)	0.69 (14.39*)	0.88 (38.18*)
Z	1.18 (0.55)	1.4 (1.31)	1.63 (0.81)	0.30 (0.31)
Z (Real output)	-0.11 (-1.6)	-0.03 (-0.5)	-0.15 (-2.28*)	-0.04 (-0.84)
Z (IBCR)	0.01 (0.83)		0.01 (1.37)	
Z (Inflation rate)		0.0142 (2.85*)		0.0132 (2.94*)
Z(Lagged dependent)	-0.0008 (-0.35)	-0.0015 (-1.36)	-0.0011 (-0.51)	-0.0002 (-0.16)
MA(1)	0.47 (4.04*)		0.42 (3.85*)	
MA(2)	0.35 (2.93*)		0.32 (2.92*)	
MA(4)		0.26 (2.32*)		
R^2	0.987	0.994	0.988	0.995
D.W.	1.93	1.78	1.97	2.1
F Statistics	706.1	1653.68	775.47	2274.79
Incremental F-statistics	0.68	1.75	1.54	2.88*

Z is a dummy variable that is set equal to zero for the period prior to the first quarter of 1992 and one afterwards.
Note: *and ** indicate significant at 5% and 10% levels respectively.

The result that the money demand function has become more sensitive to inflation rate during the later period of our analysis is also supported by the earlier studies that found an insignificant effect of inflation rate on demand for money (e.g. Abe et al. 1975 and Khan 1980).

Before conclude the study, we want to make sure that our results of estimation pass the tests of co-integration. The testing procedure is explained in Section 3 in terms of three conditions for co-integration. First consider the qualitative condition that the sample size should be large. We have a sample size of 96 quarterly observations that can be considered large enough to apply quantitative tests of co-integration.[3] Now to verify that all the variables in the estimated equations are non-stationary but integrated of the same order, we applied unit root test on all the variables. These tests, known as Augmented Dickey-Fuller (ADF) tests are applied with and without an intercept, with and without trend and with zero, one, two, three and four lagged first difference terms in the Dickey-Fuller equation. The tests revealed that all the variable had a unit root, that is, they are non-stationary. However, the first difference of each variable does not have a unit roots. Therefore all the variable are non-stationary and integrated of the same order, that is one.

The above result means that the estimated equations can possibly form a co-integrating linear combination of the variables considered in the respective equations, that is the necessary condition for co-integration is satisfied. To test the sufficient condition, we applied unit root tests on the regression residuals that form the required linear combination. The results show that the regression residuals are stationary and, hence integrated of a lower order, that is zero.

Thus it is confirmed that all the money demand functions reported above hold in the long run and they can be used for forecasting purposes, specially to predict the effects of shocks that can effect money demand such as changes in interest rate or inflation rate and real output.

[3] Ali (1994) used only 20 annual observations for co-integration analysis. In a similar study Hossain (1994) has used 21 annual observations for the same purpose. Khan (1994) has, however, used 88 quarterly observations, which provide a sufficiently large sample size.

6. CONCLUSIONS

In this study we have re-examined the effect of real and nominal income, the price level, the interest rate and inflation rate on money demand in Pakistan. We used alternatively the narrow definition of money that is currency in circulation plus demand deposits and other deposits as well as the broad definition of money that is narrow money plus time deposits. In addition the money balances are measured alternatively in nominal as well as in real terms. The analysis is based on quarterly data over the period 1972.11 to 1996.1. Some of the main conclusions and policy implications that come out of this research are noted below.

As the matter of cost of holding money is concerned, we find that inflation rate is a more relevant factor in determining money demand as compared to the nominal interest rate. This result has important implication for our monetary policy. Since the nominal interest rates have not increased sufficiently in one-to-one correspondence with inflation, the real interest rates have either turned negative or they are extremely low. This means that the monetary authority in Pakistan has effectively lost its control on money demand via the policy of pegging interest rate. Since money demand responds more actively to inflation rate than to the interest rate, it is the inflation rate that could be pegged (that is, used as an instrument) in order to control and or stabilize money demand.

Our second major conclusion is that money demand responds to various variables such as output, price level, inflation rate, etc. sluggishly due to strong inertia or slow adjustment. This also means that money demand would respond sluggishly to various shocks. An obvious implication of this result is that in the short-run money demand is not too sensitive to shocks. Another implication is that if the authorities apply any policy to change money demand in a particular direction by a targeted magnitude, the desired outcomes will be realized with some time lag. Put in different terms, the authority should be aware of the speed of adjustment in money demand while setting its targets so that the realized outcomes are consistent with the targeted objectives.

Another result is that money demand is more sensitive to changes in general price level than to the changes in real output. This information can also be used meaningfully by the monetary authority while adjusting high-powered money to maintain equilibrium between supply and demand for money so that the money market remains stable.

Our results also reveal that a structural shift in the demand for time deposits has occurred after the financial reforms in early 1990s. This structural shift has made money demand more sensitive to inflation rate. This result reinforces our earlier conclusion regarding the relative roles of interest rate and inflation in stabilising and targeting money demand.

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