MONEY DEMAND FUNCTION FOR PAKISTAN (DIVISIA APPROACH)

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Abstract. The money demand function plays a key role in monetary policy formulation. Pakistan economy witnessed severe monetary problems in last few years, which call for a thorough investigation of the root cause. The study tried to estimate money demand function using Divisia type-weighted aggregates, instead of Simple sum official aggregates. Both long run and short run money demand functions were estimated and Stability was also tested. The money demand function based on broader Divisia aggregate ($DivM_2$) was found to be the stable money demand function for Pakistan. The results indicated that the Divisia based money demand estimates were more realistic and had more information content. The study suggested that State Bank of Pakistan should abandon the Simple sum aggregation technique and switch over to the Divisia aggregates, which have more aggregation theoretic foundations.

I. INTRODUCTION

The money demand function plays a pivotal role in monetary policy formulation. Over the last decade or so, the financial landscape of Pakistan has undergone significant changes. The experience of liquidity crisis and its devastating consequences on the economy call for a thorough and in-depth analysis of the root cause. Monetary aggregates play the role of anchor in monetary policy formulation. Modern literature has shed doubts over the conventional monetary aggregation techniques. The aggregation techniques may be the root cause of instability of money demand function and monetary

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problems. Monetary and Financial Statistics Manual (MFSM) of IMF states that, "The Financial instruments with higher transaction cost (with relatively less liquidity) can be classified under broader monetary aggregates and *vice versa*" (IMF, 2000). These guidelines clearly advocate the use of weighted aggregates, while in Pakistan; the State Bank of Pakistan is using Simple sum aggregates.

The demand for money was mostly studied at macroeconomic level, but in order to find out the main determinants of money demand, there was a need to perform deep analysis of its microeconomic foundations. Currently, the common practice among central banks was to construct money measures from a list of possible components by simply adding together those assets that were considered likely sources of monetary services. These were usually highly liquid financial assets and the approach was referred in the literature as *simple-sum* aggregation (Serletis, 2007).

In recent years, however, such a monetary aggregation procedure was questioned and explicit attention was focused on the use of microeconomic and aggregation-theoretic foundations in the construction of monetary aggregates. Currently, in most of the central banks for monetary aggregation, Simple-Sum Index was widely used. In Simple-Sum aggregation, all monetary components are treated as dollar-for-dollar perfect substitutes.

Simple-sum aggregation is vastly used in the literature; however, it is defensible only if the component assets are perfect substitutes. Barnett (1980), in his classic article, "Economic Monetary Aggregates: An Application of Index Number and Aggregation Theory" raised many objections on the application of simple-sum aggregation and suggested the use of Index number theory for aggregation. Diewert (1976) attached the economic properties to the statistical indices and thus devised the link between aggregation theory and statistical index number theory, which paved the way for weighted monetary aggregates.

In Pakistan, the State Bank of Pakistan was still using the simple sum method for monetary aggregation which was replaced by Divisa aggregates in many advanced countries. Moreover, microeconomic foundations of demand for money, which were helpful in devising a sound monetary policy, were yet ignored. In Pakistan, most of the literature focused only the official aggregates and the monetary sector research was confined to the estimation of money demand function and testing its stability. The only study on the topic which compared the simple sum and Divisia indices was that of Tariq and Matthews (1997), but this study was conducted in a period when financial sector of Pakistan was not much developed.

The demand for money decision basically emerged from the individual choice behavior, thus there was a need to analyze the factors, which played significant role in the determination of an individual's cash balance decision. The current study tried to bridge this gap in Pakistani literature. Rest of the study is organized as: next comes the comparison of Simple sum and Divisia aggregates in the literature, after that the formulation of Divisia aggregates was discussed, followed by Analysis of Money demand function based on these aggregates. In this analysis, first time series properties of the data were tested and then one by one all three aggregates were used for money demand analysis. At the end the results of overall analysis were summarized and some insights were gathered.

II. SIMPLE-SUM AND DIVISIA MONETARY AGGREGATES

The Simple-sum monetary aggregation has the problem that it disregards the 'Prices'. A 'price' in the context of monetary assets is the opportunity cost of holding money, or, in other words, the 'User cost of the money'. For these reasons, Friedman and Schwartz (1982), Barnett (1980) and Barnett *et al.* (1984) raised objections against simple sum aggregation and Fisher (1922) described simple sum as the most awful possible index based on its known properties. In this situation, weighted aggregates (Divisia type) appeared as a substitute; which were free of the pitfalls of the simple sum aggregates.

A significant number of studies have established empirically the supremacy of Divisia over simple sum aggregates. Barnett (1980, 1983), Barnett *et al.* (1984) and Acharya and Kamaiah (2001) have strongly recommended the Divisia as the superior aggregate. Belongia (1996), Anderson, Jones and Nesmith (1997), Lucas (2000), Schunk (2001), Stracca (2001, 2004), Duca and VanHoose (2004), and Drake and Mills (2005) provided recent discussions on the merits of the Divisia index relative to the conventional simple sum index.

In spite of strong theoretical background of Divisia, most of the central banks still follow simple sum aggregates, with the argument that both these aggregates provide more or less similar results. But recent literature was strongly advocating the clear-cut differences between the robustness of Divisia and simple sum aggregates. Belongia (2005) opined that it would not be true to describe little differences in the statistical estimates of the two aggregates as 'insignificant differences', because the simple sum aggregation did not have any theoretical base or statistical properties.

III. FORMULATION OF DIVISIA MONETARY AGGREGATES

Barnett (1978) introduced the idea of 'User Cost of Money', which was actually the foundation stone for microeconomic analysis of the monetary aggregation process. User cost of monetary assets enabled the economists to investigate the representative consumer's choice set, not only over the consumption goods, but also the monetary services. Thus, representative consumer's utility was now a function of consumption goods, leisure and monetary services.

$$u = u\,(c, l, x) \tag{1}$$

Where:

  c = vector of the services of consumption goods

  l = leisure time, and

  x = vector of the services of monetary assets.

As this was a weakly separable utility function, the study focused only towards the consumer's monetary problem. Following Serletis and Shahmoradi (2005, 2007), the study assumed that the consumer' monetary problem as:

  $\max f\,(x)$ subject to budget constraint $p'x = y$

where 'x' as defined above was the vector of services of monetary assets, p was the corresponding vector of monetary assets' user cost and 'y' was the expenditure on monetary services. As the monetary assets were of different nature, so the utility function of the consumer became

$$f\,(x) = f\,(f_A\,(x_1, x_2, x_3, x_4), f_B\,(x_5, x_6, x_7, x_8), f_C\,(x_9, x_{10}) \tag{2}$$

where x_1 to x_{10} were different monetary assets. Details are given in Table 1.

Keeping in view these subgroups, Divisia Quantity and Divisia Price Indices were calculated. The annual data for Pakistan economy is used comprising the time period of 1972-2007. Main data sources are Handbook of Statistics on Pakistan Economy (2005) by State Bank of Pakistan (SBP), various Statistical Bulletins of State Bank of Pakistan and CD-ROM of International Monetary Fund (IMF). For designing the demand system based on above given objective function instead of using the simple-sum index, the Divisia quantity index was estimated to allow for less than perfect substitutability among the monetary components. Based on above given sub-grouping, three Divisia quantity aggregates namely; $DivM_0$, $DivM_1$, and

DivM$_2$ were designed. For formulating Divisia quantity aggregates, the study used the methodology given in Barnett (1980) and used by Serletis (1988, 1991) and Serletis and Shahmoradi (2005, 2007).

TABLE 1

Component Assets of Monetary Subgroups

Sub-Group	Variable name	Asset
A	X_1	Currency in Circulation
	X_2	Other Deposits with SBP
	X_3	Currency in tills of Scheduled Banks
	X_4	Banks' deposits with SBP
B	X_5	Current Deposits
	X_6	Call Deposits
	X_7	Other Deposits
	X_8	Saving Deposits
C	X_9	Time Deposits
	X_{10}	Residents Foreign Currency Deposits

$$\log M_t^D - \log M_{t-1}^D = \sum_{j=1}^{n} w_{jt}^* \left(\log x_{jt} - \log x_{j,t-1} \right) \tag{3}$$

Where the left hand side of equation showed growth rate in Divisia aggregate over two periods of time, on the right hand side the factor $\left(\log x_{jt} - \log x_{j,t-1} \right)$ was the growth of quantities of component assets, while w_{jt}^* was the Divisia weight. The composition of Divisia weights was defined as the expenditure shares averaged over the two periods of the change.

$$w_{jt}^* = \frac{1}{2} \left(w_{jt} + w_{j,t-1} \right) \tag{4}$$

for $j = 1, ..., n$, where w_{jt} was the expenditure share of asset j during period t, and was calculated as:

$$w_{jt} = \frac{p_{jt} x_{jt}}{\sum_{k=1}^{n} P_{kt} x_{kt}} \tag{5}$$

where p_{jt} was the nominal user cost of asset j, derived in Barnett (1978) as,

$$p_{jt} = p^* \frac{R_t - r_{jt}}{1 + R_t} \tag{6}$$

According to Barnett (1978), user cost was the opportunity cost of holding a certain amount of the jth asset. In the given expression, P^* was the true cost of living index, r_{jt} was the market yield on the jth asset, and R_t was the yield available on a 'benchmark' asset that is held only to carry wealth between multi periods.

The selection of benchmark asset was also an issue. The previous studies used gilt yields, corporate bond yields and Treasury bill yields etc. as the benchmark assets. But as Drake and Fleissig (2004) identified that it was possible for the yield on an asset to occasionally exceed the benchmark return, producing a negative rental price, a particular asset should not be nominated as benchmark. Due to this reason, the study followed Drake and Fleissig (2004) and used 'envelope approach', in which the benchmark asset was decided for each period separately, depending upon the yield for that particular period. In this way different assets could have been the benchmark for different years.

After formulating the Divisia quantity index, its corresponding Divisia price index was formulated. Divisia price index is also termed as Divisia Price Dual. The price dual was calculated as:

$$\log P_t^D - \log P_{t-1}^D = \sum_{j=1}^{n} w_{jt}^* \left(\log p_{jt} - \log p_{jt-1} \right) \tag{7}$$

Where, P_t^D was price dual of Divisia and p_{jt} was the user cost of monetary asset 'j' in time period t.

This price dual of Divisia was defined as the weighted sum of the rate of change of the prices of component assets, where the weights were defined as the shares of component assets in the total expenditure on all assets in the index. The remaining procedure and data was similar to that of Divisia quantity index.

IV. MONEY DEMAND ANALYSIS BASED ON DIVISIA MONETARY AGGREGATES

After the formulation of three Divisia quantity aggregates and their corresponding three Divisia price duals, the stability of demand function

based on Divisia aggregates was checked. For this purpose, the same methodology was repeated, that was used for the simple-sum aggregates — M_0, M_1 and M_2. First, the individual series were tested for unit root and the Cointegration tests were applied, to check for long run relationship. At the end, Error Correction Mechanism (ECM) was used to capture the short run effects of the model.

An important step in the formulation of Divisia quantity indices and their corresponding price duals was the choice of benchmark asset. Instead of choosing a specific monetary asset as a benchmark asset, this study followed Drake *et al.* (2003) and used envelopment approach. In this way different assets could perform as benchmark asset for different years. The indices, thus formulated were free of many drawbacks, which could result due to a specific benchmark asset.

These weighted aggregates and their price duals were then subjected to stationarity check and then money demand functions based on these money aggregates were formulated through cointegration and ECM methodologies. Divisia aggregates were designed through the procedure outlined in previous paragraphs and their corresponding price duals were obtained through overtime cumulating the weighted sum of individual prices of assets. The shares of component assets in the total expenditures were treated as weights. These series were used for further analysis of money demand function.

STATIONARITY AND COINTEGRATION

In order to test for stationarity, all three Divisia aggregates were subjected to Augmented Dickey Fuller test. The results indicated that all three newly constructed time series of Divisia Monetary aggregates and their price duals were stationary at levels, but the log of real GDP (LRGDP) and log of financial innovations (LFI) were non-stationary at levels (Financial Innovation is captured through the ratio of M_2 minus Currency in circulation over GDP; Ratio of M_2 – CC/GDP). Both these variables were stationary at first difference.

As the results in Table 2 indicated, all the three monetary aggregates (DivM$_i$) and their price duals (PD$_i$) were stationary at levels. The study was aimed at exploring the long run money demand relationship and rest of the variables in the model were integrated of order one, so the order of integration of the model variables was not the same. In this situation the Johansen and Juselius (1990) approach was also not applicable. If order of integration of the model variables was not the same, the only available option was to use Autoregressive Distributed Lag (ARDL) approach.

TABLE 2

Augmented Dickey-Fuller Test for Unit Root in Level I(0)

Variables	With Intercept but No Trend	With Intercept and Trend
$DivM_0$	–4.541*	–6.579*
$DivM_1$	–4.669*	–4.937*
$DivM_2$	–4.923*	–5.050*
PD_0	–6.654*	–6.535*
PD_1	–5.912*	–5.846*
PD_2	–5.826*	–5.755*
LRGDP	–1.156	–1.749
LFI	–2.117	–2.778

*The coefficient is significantly different from zero at 0.05 percent probability level.

The ADF statistic are –2.9591 and –3.5615 for models 'with Intercept but no Trend', and 'with Intercept and Trend' respectively at 0.05 percent probability level.

ARDL approach was introduced by Pesaran *et al.* (1996) and was applied in this study through two step procedure as described in Pesaran *et al.* (1996). First, for the checking of existence of any long run relationship between the model variables, a joint hypothesis was tested. The null hypothesis that there was no long run relationship between the model variables was tested against the alternative hypothesis of existence of long run relationship.

MONEY DEMAND MODEL BASED ON $DivM_0$

The money demand models based on Divisia Reserve money ($DivM_0$) was a function of log of real GDP, Price dual of Divisia (PD_0) and log of financial innovation (LFI). Among these variables, $DivM_0$ and PD_0 were integrated at levels, *i.e.* I(0), while LRGDP and LFI were I(1), hence ARDL approach was the logical choice for cointegration analysis. In ARDL approach, there were two steps involved; as a first step, the hypothesis for the existence or otherwise of long run relationship was tested. Here the choice of order of VAR was of utmost importance, because the F-statistic of joint hypothesis was sensitive to the order of VAR. The ARDL equation used in this regard was:

$$DDivM_{0t} = a_0 + \sum_{i=1}^{n} b_i DDivM_{0,t-i} + \sum_{i=1}^{n} c_i DLRGDP_{t-i} + \sum_{i=1}^{n} d_i DPD_{0,t-i}$$

$$+ \sum_{i=1}^{n} e_i DFI_{t-i} + \delta_1 DivM_{0,t-1} + \delta_2 PD_{0,t-1} + \delta_3 LRGDP_{t-1} \quad (8)$$

$$+ \delta_4 LFI_{t-1} \cdots$$

Where, a, b, c, d, e, and δ_i were coefficients, D was used for difference of variables, and 'n' indicated the number of lags used.

The F-statistic so obtained was compared with the critical values provided in Pesaran and Pesaran (1997) and Pesaran *et al.* (2001). These critical values were different for different models as well as for the number of regressors. The F-statistic of the reserve money model with 'Unrestricted intercept and no trend' was 5.8835, while the critical value lower and upper bounds for $j = 3$ were 3.800 and 3.219 respectively at 5 percent level of significance ('j' indicated the number of regressors). As the F-statistic was greater than upper bound at 5 percent level of significance, it was the indication of existence of long run relationship between money demand and other model variables.

TABLE 3

Autoregressive Distributed Lag Estimates of $DivM_0$
ARDL (0, 1, 1, 0) Selected Based on AIC

Regressor	Coefficient	Standard Error	T-Ratio
PD_0	–0.019**	0.005	–3.664
$PD_0(-1)$	–0.044**	0.020	–2.202
LRGDP	20.737*	12.032	1.723
LRGDP(–1)	–17.228	16.841	–1.439
LFI	42.114	39.479	1.067
C	147.126***	10.786	13.641
R-Square = 0.42			
DW stat = 2.491			
F-stat = 3.982			

*, ** and *** indicate that coefficients are significant at 0.10, 0.05, 0.01 percent probability level respectively.

The next step in ARDL methodology was finding out ARDL estimates and error correction representation. In this regard, the lag orders of the variables were selected through Akaike Information Criterion (AIC), in other options; R-square, Schwarz Bayesian Criterion (SBC) and Hannan and Quinn Criterion (HQC) were available. The study used all the four criteria but AIC was found better in the present case at order of VAR equal 2. The estimations were carried out in Microfit software in which the lag length of variables was selected under inbuilt algorithm. ARDL estimates of the model of Divisia M_o were computed and these estimates were based on AIC. The results were given in the Table 3.

The results shown above indicated that the price dual of Divisia (PD_0) was significantly affecting the demand for money both at levels and also at first lag. There was a negative relationship between quantity of money demanded and price of money (Price dual). Moreover, relationship of income and money demand was also significant at 0.10 percent probability level. Larger coefficient of income variable indicates that increase in GDP results in higher demand for liquid assets, *i.e.* M_0. But the variable of financial innovations was not significant. R-square, Durban Watson statistic and F-statistic were normal, showing good statistical properties of the model.

The long run coefficients of the ARDL model with ARDL (0, 1, 1, 0) were also showing the same pattern as of ARDL estimates. Once again in long run estimates, the coefficients of price dual and real GDP were significant but the coefficient of financial innovation was not significant. The long run reserve money demand function was:

$$DivM_0 = 147.1263 - 0.0635 \; PD_0 + 3.5109 \; LRGDP + 42.1141 \; LFI \qquad (9)$$
$$(13.6406) \quad (-1.8465) \qquad (3.4323) \qquad \quad (1.0667)$$

(t-values were in parenthesis)

This long run relationship was illustrating that one unit change in price of money resulted in 0.06 units decrease in demand for money and one unit increase in real income resulted in 3.5 units increase in the demand for money. The reserve money demand function based on Divisia described that there was no significant impact of financial sector developments on the demand for reserve money in the long run. This phenomenon indicates that most of the financial instruments introduced were focused at mobilizing savings or consumer financing and not for the increase in reserve money.

In order to capture the dynamics of the money demand function error correction model was estimated. The results of error correction representation were shown in Table 4.
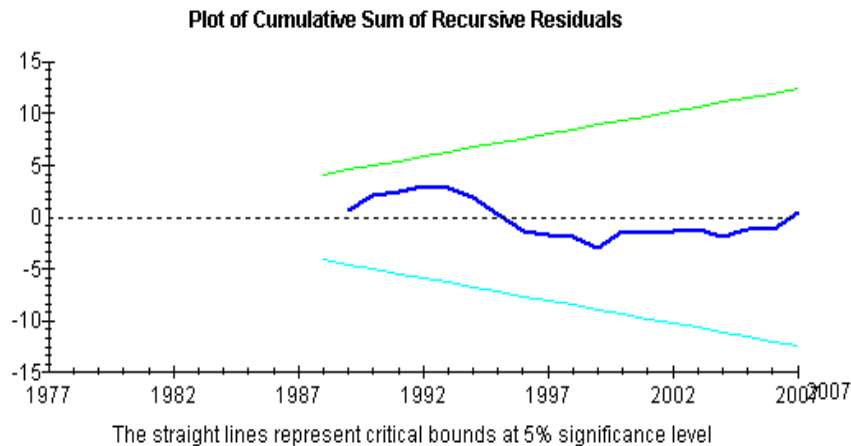
TABLE 4

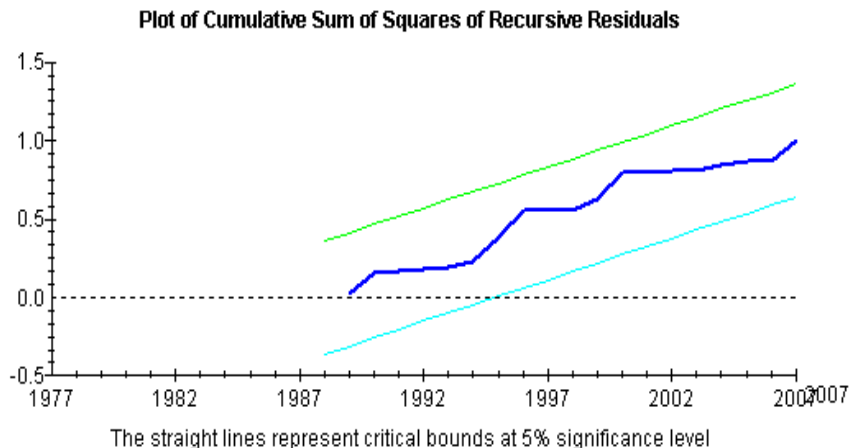Error Correction Representation for $DivM_0$ ARDL Model

Regressor	Coefficient	Std Error	T-Ratio	Prob.
Intercept	147.126***	10.7859	13.6406	0.000
DPD_0	−0.1917***	0.0052	−3.6644	0.007
DLRGDP	20.737***	12.0324	1.7234	0.078
DLFI	42.1141	39.4797	1.0667	0.295
ECM(−1)	−0.820	0.3141	2.6110	0.02
R-Square = 0.68				
DW stat = 2.491				

*, ** and *** indicate that coefficients are significant at 0.10, 0.05, 0.01 percent
  probability level respectively

The results of error correction model indicated that in the short-run opportunity cost variable (Price dual of Divisia) had a negative and significant impact on money demand, while real income also had a strong and highly significant impact on individual decisions of money demand. The error correction term showed a high speed of adjustment of disequilibrium.

FIGURE 1

CUSUM and CUSUMSQ Plots of $DivM_0$ Model

Plot of Cumulative Sum of Recursive Residuals

The straight lines represent critical bounds at 5% significance level

Plot of Cumulative Sum of Squares of Recursive Residuals

The straight lines represent critical bounds at 5% significance level

The CUSUM and CUSUMSQ plots of the residuals of the model showed a consistent and stable pattern, indicating that the long run relationship was a stable relationship (Figure 1).

MONEY DEMAND MODEL BASED ON DivM$_1$

After the estimation of reserve money function, the narrow money demand function was estimated. DivM$_1$ was a broader than the DivM$_0$ aggregate, because it contained along with all the components of DivM$_o$, current deposits, call deposits and the saving deposits as well. The behavior of DivM$_1$ was expected to be different from the reserve aggregate. As mentioned in the previous section, two variables of the narrow money function namely; DivM$_1$ and PD$_1$ were stationary at levels and rest of the variables, *i.e.* LRGDP and LFI were integrated of order one, so the possible option for cointegration analysis was the ARDL approach. The ARDL model of DivM$_1$ was subjected to cointegration analysis with first differences of PD$_1$, LRGDP and LFI with lags. In the first step of ARDL based cointegration analysis, the joint hypothesis of presence of long run relationship was tested and the value of F-statistic was compared with the ARDL critical bounds given in Pesaran *et al.* (2001). As the F-statistic (7.1561) was greater than the upper bound (3.219), which indicated the presence of long run relationship. Thus on the basis of this cointegration result, the ARDL estimates were achieved with order of VAR 2 and by using AIC for lag selection. The Akaike Information Criterion selected the lag length of (4, 4, 3, 3) for DivM$_1$, PD$_1$, LRGDP, and LFI respectively. The long run estimates for the reserve money demand (DivM$_1$) were:

TABLE 5

Long run Coefficients for $DivM_1$ Based on ARDL (4, 4, 3, 3) Model

Regressor	Coefficient
PD1	–0.0034* (–1.7258)
LRGDP	5.0320** (2.2318)
LFI	–49.9880 (–0.3544)
Intercept	169.9308*** (4.6572)
R-square = 0.74	
DW statistic = 2.66	

*, ** and *** indicate significant at 0.10, 0.05 and 0.01 percent probability level respectively.

(t-values in parenthesis)

The results showed that price dual of Divisia and real income were significant at 0.01 percent and 0.05 percent probability levels respectively as well as both had the correct signs, but once again financial innovation was insignificant and also had negative sign, which was contrary to the economic theory. The results were illustrating that the long run money demand function was dependent upon user cost of asset and income.

TABLE 6

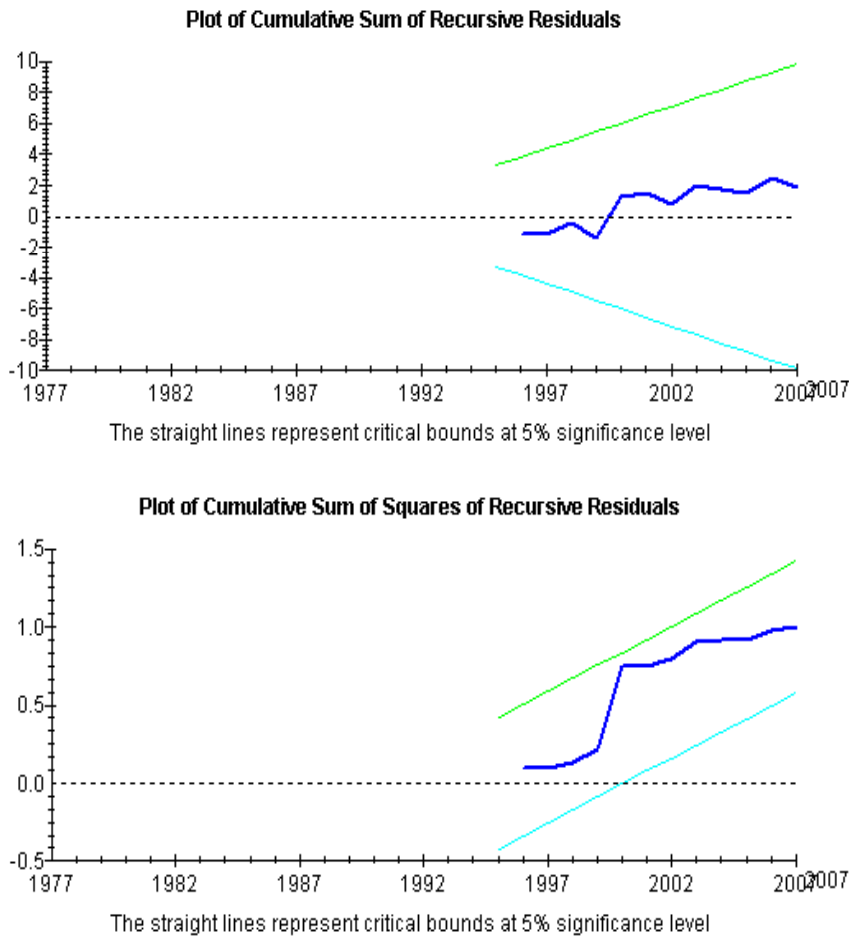Error Correction Representation for $DivM_1$ ARDL Model

Regressor	Coefficient	Std Error	T-Ratio	Prob.
Intercept	164.208***	65.145	2.521	0.023
$dDivM_13$	0.356*	0.199	1.794	0.092
dPD_12	–0.034***	0.012	2.709	0.010
dLRGDP	40.111*	22.086	1.816	0.081
dLFI1	280.745***	97.375	2.883	0.011
ECM(–1)	–0.966***	0.385	–2.510	0.023
R-Square = 0.85				
DW stat = 2.65				

*, ** and *** indicate that coefficients are significant at 0.10, 0.05,0.01 percent probability level respectively.

The analysis of error correction model represents that most of the variables were significant at 10 percent probability level and at most of the lag lengths the variables showed correct signs. In few lagged variables the significance was not achieved. The error correction term was indicating the disequilibrium of the previous period being corrected with very high speed.

The results were confirmed through the check of stability of residuals. Both the CUSUM and CUSUMSQ plots were within the 5 percent critical bounds (Figure 2).

FIGURE 2

CUSUM and CUSUMSQ Plots of $DivM_1$ Model

Plot of Cumulative Sum of Recursive Residuals

The straight lines represent critical bounds at 5% significance level

Plot of Cumulative Sum of Squares of Recursive Residuals

The straight lines represent critical bounds at 5% significance level

MONEY DEMAND MODEL BASED ON $DivM_2$

The $DivM_2$ was the broad money aggregate which included the components of $DivM_0$, $DivM_1$ and time deposits. These aggregates were designed with the same components as were in the official aggregates M_2 but the methodology of aggregation was different. The official aggregates were formulated through simple summation but $DivM_2$ was designed through the weighted aggregation based on relative moneyness of the component assets.

The long run money demand function based on broad money was the function of broad money's corresponding price dual (PD_2), real income (LRGDP) and financial innovation (LFI). The variables of $DivM_2$ and PD_2 were stationary at levels as shown in the Table 2 and rest of the model variables were integrated of order one. This mixed order of integration of model variables illustrated that ARDL approach was the logical choice for Cointegration analysis and error correction mechanism.

In the first step of cointegration analysis, through single equations approach the joint hypothesis of 'no cointegration' among the model variables was tested against the presence of cointegration. The null hypothesis of 'no cointegration' was rejected because the calculated F-statistic (6.0741) was greater than the upper bound of ARDL critical values (3.219). Non-acceptance of the null hypothesis implied the existence of long run money demand relationship based on Divisia broad money ($DivM_2$).

TABLE 7

Autoregressive Distributed Lag Estimates for $DivM_2$
ARDL (0, 1, 0, 0) selected based on SBC

Regressor	Coefficient	Standard Error	T-Ratio
PD_2	–0.037*	0.021	–1.731
$PD_2(-1)$	–0.030*	0.017	–1.809
LRGDP	3.475*	1.958	1.775
LFI	175.843**	76.186	2.308
C	151.956***	19.796	7.676
R-Square = 0.43			
DW stat = 1.96			

*, ** and *** indicate that coefficients are significant at 0.10, 0.05, 0.01 percent probability level respectively.

In the second step, the ARDL estimates, long run coefficients and error correction model were estimated. For the estimations, order of VAR was specified as two and results with all criteria were calculated, but SBC based results were more robust. The ARDL estimates based on Schwarz Bayesian Criterion were reported in Table 7.

The ARDL estimates were based on SBC and selected lag length was (0, 1, 0, and 0) for $DivM_2$, PD_2, LRGDP and LFI respectively. These ARDL estimates were of secondary importance, while the long run coefficients were of the prime importance which illustrated the magnitude and direction of the relationship.

The long run coefficients of the model were:

$$DivM_2 = 151.9562 - 0.0670\ PD_2 + 3.4754LRGDP + 175.8430LFI \qquad (10)$$
$$(7.6760)(0.0281)(1.7747)(2.3081)$$
(Values in parenthesis were t-values)

This long run relationship indicated that price dual of Divisia M_2 (opportunity cost of money) had a negative relationship with the demand for broad money, while real income and financial innovation had positive impact on money demand. These results were in line with the economic theory and indicated that as the user cost of money or opportunity cost of holding money decreased, people preferred to hold more balances. Similarly, with the increase in money incomes, people also demanded more money, while easy financial developments and sophistications in modes of payment and lesser user cost in terms of time and money for drawing the money also positively effects the demand for money in the long run.
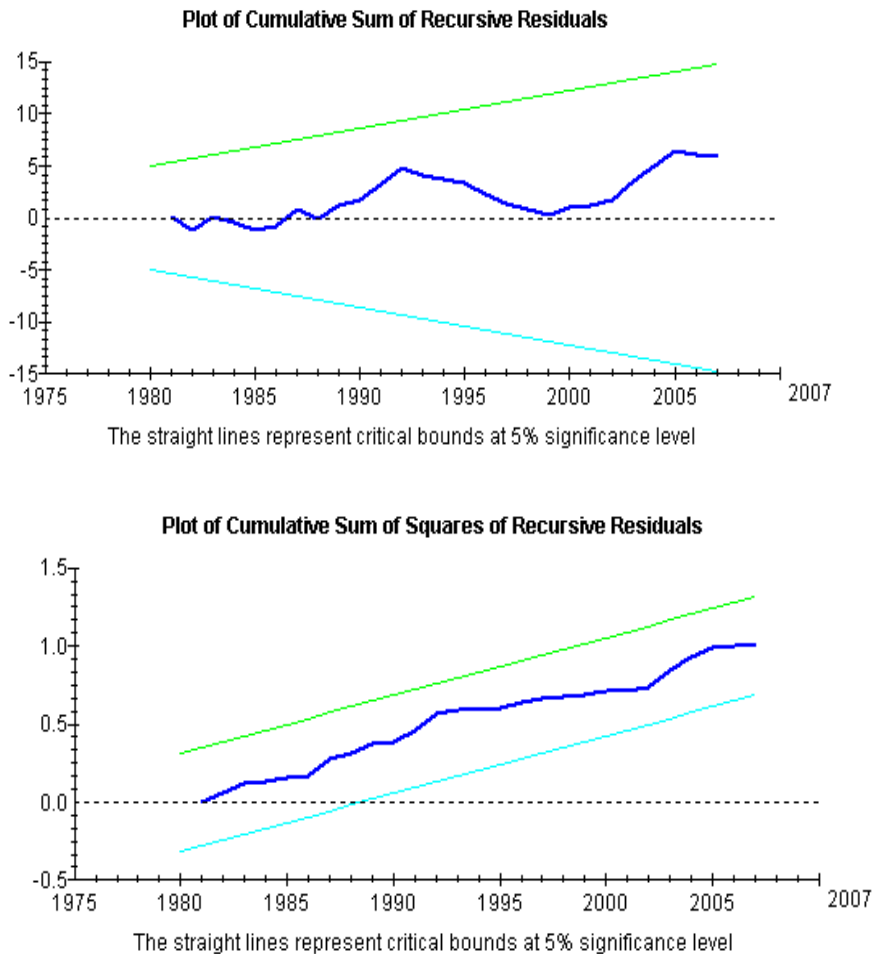
TABLE 8

Error Correction Representation for $DivM_2$ ARDL Model

Regressor	Coefficient	Std Error	T-Ratio	Prob.
Intercept	151.956***	19.796	7.676	0.000
dPD_2	–0.037*	0.021	–1.731	0.089
dLRGDP	3.475*	1.958	1.775	0.087
dLFI	175.843**	76.186	2.308	0.029
ECM(–1)	–0.983**	0.451	2.179	0.029
R-Square = 0.6095 DW stat = 1.9633				

*, ** and *** indicate that coefficients are significant at 0.10, 0.05,0.01 percent probability level respectively.

The results of ECM also showed that the disequilibrium of the previous period was almost fully settled in the current period as was evident from the coefficient of the error correction mechanism. The results for short run indicate that statistically there is more sound relationship among the model variables as compared with the long run estimates. The statistical properties of the model were also satisfactory as shown by the results in Table 8.

FIGURE 3

CUSUM and CUSUMSQ Plots of $DivM_2$ Model

Plot of Cumulative Sum of Recursive Residuals

The straight lines represent critical bounds at 5% significance level

Plot of Cumulative Sum of Squares of Recursive Residuals

The straight lines represent critical bounds at 5% significance level

In order to check the stability of the long run and short run estimates, the residuals were subjected to CUSUM and CUSUMSQ tests. The CUSUM and CUSUMSQ plots indicated that the recursive residuals and their squares,

both were within 5 percent significance bounds indicating the stability of the money demand function. The CUSUM and CUSUMSQ plots are given in Figure 3.

These Divisia based results of money demand models were little at variance with the only study in Pakistan on the topic, *i.e.* Tariq and Matthews (1997). The study by Tariq and Matthews (1997) concluded that in Pakistan there was not much difference in results of money demand relationship based on simple sum and Divisia aggregates. The present study showed that the Divisia based aggregates have more elaborate results as compared with their simple sum counterpart. The variable of financial innovation was significant, which was an indication of the development of the financial sector of Pakistan. Serletis (2005) pointed out that in the initial stages of financial development, the economies of scale were not available, so financial development did not show significant impact on money demand, but after achieving the economies of scale, the transaction costs come down and the money demand would be positively affected.

As the results of two studies indicate gradual increase in effectiveness of weighted aggregates, the observations of Serletis (2005) indicate that monetary aggregates should be formulated using weighted aggregation. Although, the results of current study are not supporting the hypothesis of discarding simple sum method more convincingly, yet these results are hinting towards the reason for ineffectiveness of current interest rate targeting policy of SBP.

In the light of above results and the guidelines of International Monetary Fund for monetary aggregates, it is imperative for the State Bank of Pakistan to switch over to the weighted aggregation system, because it will ensure the effectiveness of the monetary policy. Moreover, the results of long run and short run analysis suggest that income and financial development play a significant role in the money demand decision of the individuals. The role of interest rate as an effective monetary policy tool has been over emphasized. The study indicated that only interest rate targeting cannot provide monetary economic stability. For an effective monetary policy, true monetary aggregates can serve as the guidelines for the policy makers.

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