Exchange Rate Volatility and Money Demand: An Empirical Analysis of Pakistan

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Abstract:
The main objective of this study is to investigate the impact of foreign exchange rate volatility on money demand in Pakistan. For this purpose disaggregate expenditure approach use to construct money demand function. For empirical estimation Autoregressive Distributed Lag (ARDL) approach is employed to investigate the co-integration among the money demand, exchange rate volatility, investment expenditure, consumption expenditure, government expenditure and inflation. The long run results show that household's consumption expenditures, investment expenditure and inflation has positive and significant relationship with money demand in case of Pakistan. On the other hand, the long run results relating to government expenditures and exchange rate volatility show negative and significant impact on money demand.

Keywords: Exchange Rate volatility, Inflation, Money Demand

JEL Classification Numbers: E30, E31, E41

1. Introduction:

Macroeconomics deals mainly with three outcome variables such as output, inflation and unemployment. These three outcomes have number of macroeconomic implications. To analyze macroeconomic behavior of an open economy, it is important to study their macroeconomic determinants, consequences and different linkages. Every economy wants to required macroeconomic stability in the long run. Normally, for this purpose economies used two policy tools, monetary and fiscal tools are used to achieve macroeconomic stability. Money demand and money supply have critical and significant role to frame monetary policy. Both are the key variables of monetary policy. Demand and supply side behavior of money has been attained more importance since the Friedman. According to him monetary variation always and everywhere creates macroeconomic fluctuation (Sriram, 1999). To frame optimal monetary policy with its different tools, analyze the behavior of those variables which determine money demand and money supply is very essential.

 For macroeconomic forecasting and stability an organized function of money demand is needed (Judd and Scadding, 1982 and Friedman, 1987). Usually, interest rate and the level of economic activity have been identified as important factors to determine money demand in a country. The interest rate has been considered as a measure of opportunity cost of holding money and the level of income as a measure of the value of all transactions. Fleming (1962) identified exchange rate

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as one of the important determinants of money demand for open economy instead of income and interest rate. Money demand of a country depends on exchange rate through different channels like net exports and planned expenditures.

There are two main channels, which consider exchange rate as important determinant of money demand, wealth and expectation. According to Arango and Nadiri (1981), a depreciation of domestic currency or an appreciation of foreign currency increases the value of foreign assets in terms of domestic currency held by domestic residents. Ultimately, the value of foreign asserts increases the wealth which leads to increase demand for domestic money. However, during appreciation of foreign currency if people expect further appreciation then public will hold more foreign currency or demand less domestic currency (Bahmani-Oskooee, 1996). For Pakistan, several studies explored the determinants of money demand in long as well as in the short run (Akhtar, 1974; Mangla, 1979; Khan, 1980; Qayyum, 1998, 2005 and Zakir, 2006). All above studies have used aggregate approach to construct money demand function without using exchange rate as determinant. Exchange rate may determine money demand in Pakistan through previously mentioned indirect channels. Money demand function is constructed in this study by using expenditure like consumption expenditure, investment expenditure, government expenditures after disaggregating aggregate demand and by using exchange rate volatility and inflation.

2. Literature Review:

A large number of theoretically and empirically studies that investigate the relationship among the money demand, macroeconomic variables and output. Hume (1970) estimates the significance of monetary policy to determine the consistent behavior of output. He states that money supply has positive relationship with industrial output. Lucas (1972) points out how money fluctuations protect the economic activity of an economy. According to him money works as a market clearing agent. Employees respond positively with their nominal wages. Money demand has important and serious implications for both developed and underdeveloped countries. Money demand has a significant role to determine the rate of interest and income. Fielding (1995) analyses the money demand functions in following countries of Africa Cameroon, Kenya, Ivory Coast and Nigeria. The results of the study support that the presence of co-integration among the variables. He describes that M2, inflation and real income have long run relationship. Similarly some other studies like, Hansen and Kim (1995), Bahamani-Oskooee (1996), Bahamani-Oskooee and Barry (2000), Bahamani-Oskooee and Bohl (2000) and Bahamani-Oskooee (2001) investigate the co-integration of money demand function. Thornton (1996) uses co-integration test to estimate money demand function in Mexico. He finds that there exist co-integrating relation between M2 and real GDP. The results of short-run relationship suggest that M2 is best policy measure to manage and control monetary policy.

Khalib (1999) estimates the money demand function in some Asian economies like South Korea, Singapore and Philippines. For this purpose he considers foreign income, domestic income, foreign interest rate, domestic interest rate, and depreciation of exchange rate as determinants of money demand. The results indicate that all above mentioned variables have significant long run relationship with money demand. Nwaobi (2002) uses Johansen co-integration to investigate the long run relationship between money supply, inflation, real GDP and interest rate. For this purpose he considers the time period from 1960 to 1995. The results indicate that the function of money supply in Nigerian economy has stability in the long run and short run. Hwang (2002) analyzes the long run relationship between M2, real GDP and real rate of interest in Korea. He uses Juselius

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maximum likelihood method to investigate the co-integration among the variables. He states that M1 does not has long run relationship with real GDP and real rate of interest in Korean economy. Qayyum (2005) estimates the function of money demand of M2 in Pakistan. For this purpose he uses Johansen co-integration and ECM to investigate the long run and short run relationships. He concludes that inflation has significant impact on money demand in Pakistan. The results show that interest rate, market rate and bond have significant role in the long run variations in money demand.

Renani (2007) estimates the money demand function in Iran using Auto Regressive Distributed Lags (ARDL) to find co-integration. The results of the study show that there exist long run relationship between M1, GDP, exchange rate and inflation. Rao (2009) investigates money demand function by using M1 in eleven countries of Asia. For this purpose he uses ARDL to analyze the co-integration. He considers the time period from 1970 to 2007. ARDL technique has advantage over some other traditional techniques because it reduces the bias of small sample size. The results of the study indicate that there is no structural break and demand for money is well-defined in Asian countries.

3. Theoretical Framework and Methodology:

The existing theories relating to money demand mostly stress on the speculative, transactions and precautionary consideration of money (Laidler, (1993) and Sriram, 1999). But some of them considered common and well known variables to find the relationship among quantity of money demanded and the real sector of the economy (Judd and Scadding, 1982). We have estimated the money demand function using income version of quantity equation which states;

$$MV = PY \qquad\qquad (1)$$

We assume that the income velocity of money (V) is constant, now we can write the money demand function as follow;

$$(M / P) = kY \qquad\qquad (2)$$

Now, it is assumed that both money demand and real balances of money are equal, as follow;

$$M\!\big/\!P^{\,d} = (M/P) \qquad\qquad (3)$$

So, therefore

$$M/P = kY \qquad\qquad (4)$$

Fleming (1962) described that policy-makers considered only closed economy to frame monetary and fiscal policy. But it was essential for them to observe open economy also. According to him, the worldwide trade of goods and services can change the pattern of an economy through different channels. Normally, Policymakers have been ignored this sector. This study has been used aggregate demand to study the money demand function in Pakistan by including open economy. The model has been estimated to studying open-economy fluctuations that affected money demand function.

For this purpose following goods market equation has been used.

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$$Y = C(Y - T) + I(r) + G + NX\,(e). \tag{5}$$

Y= Aggregate Income
C= Household's Consumption Expenditures
I= Investment Expenditures
G= Government Expenditures
NX= Net Exports

This equation indicates that consumption depends positively on disposable income Y - T. Investment depends negatively on the interest rate. Net exports depend negatively on the exchange rate (e). Exchange rate (e) is the amount of foreign currency per unit of domestic currency. According to the assumption of Mundell–Fleming model, we assume that the price levels at home and abroad are fixed, so the real exchange rate is proportional to the nominal exchange rate. We also assume that there is small open economy and perfect capital mobility. This means that the interest rate in this economy r is determined by the world interest rate r^* that is exogenously fixed. The economy is sufficiently small relative to the world economy that it can borrow or lend as much as it wants in world financial markets without affecting the world interest rate.
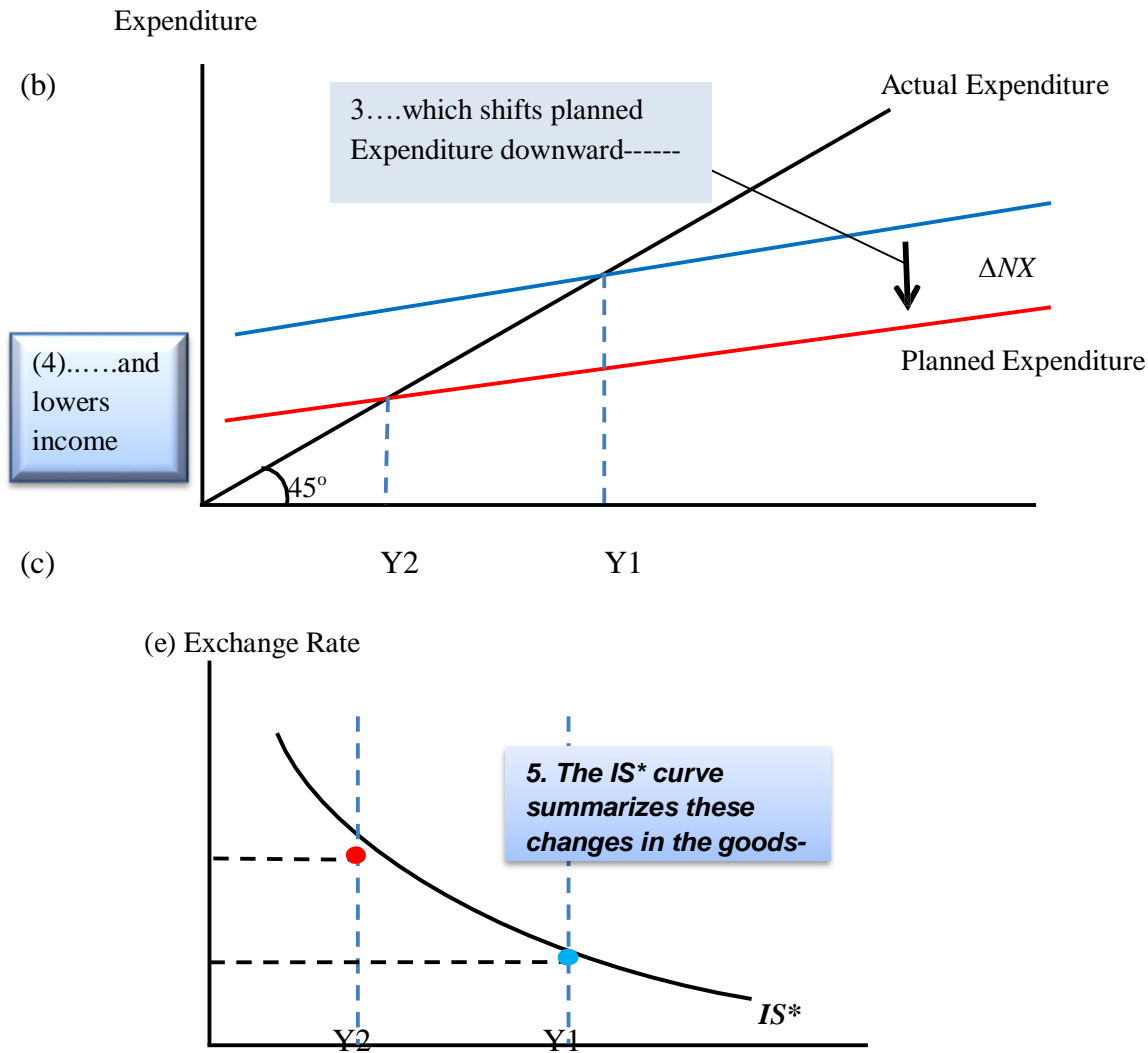
So, therefore above equation will be as follow;

$$Y = C(Y - T) + I(r^*) + G + NX\,(e). \tag{6}$$

Fig: 1
(a)
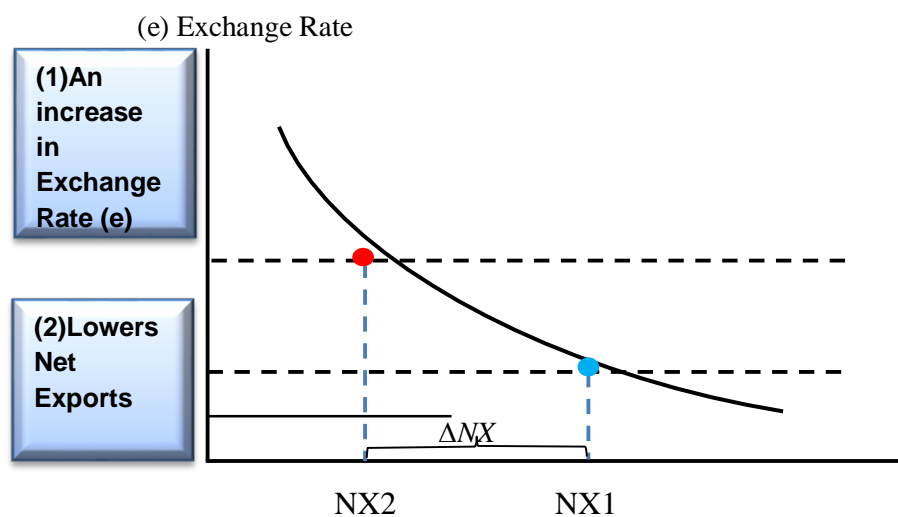
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Expenditure

(b)

Actual Expenditure

3….which shifts planned
Expenditure downward------

ΔNX

(4)..….and
lowers
income

Planned Expenditure

45°

(c)   Y2   Y1

(e) Exchange Rate

5. The IS* curve
summarizes these
changes in the goods-

IS*

Y2   Y1

IS* curve in above figure is derived from panel (a) and panel (b). Panel (a) shows the relationship between exchange rate (e) and net exports (NX). According to Fleming (1962) an increase in exchange rate from e1 to e2 lowers the net exports from NX (e1) to NX (e2) which will change planned expenditure schedule in panel (b). A downward shifting of planned expenditure schedule reduces income from Y1 to Y2. In panel (c) IS* curve summarizing these changes and shows that an increase in exchange rate from e1 to e2 reduces income from Y1 to Y2. So, it shows the negative relationship between income and exchange rate.

Figure 1 shows the impact of exchange rate on income through net exports. So, therefore on the basis of above mentioned assumptions we have used the following empirical long run function of money demand (M2) as below;

$$LnM\,2_t = a_0 + b_1 LnCE_t + b_2 LnIE_t + b_3 LnGE_t + b_4 LnER_t + b_5 LnP_t + ut \qquad (7)$$

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Where,

LnM2= Broad Money is taken as money demanded,
LnCE= Household Consumption Expenditure
LnIE = Investment Expenditure
LnER= Exchange Rate Volatility measured with the help of standard error of exchange
LnGE= Government Expenditure
LnP = GDP deflator.
Ln   = Natural Log
U= independently and Identical distributed error term and t= Time period.

4. Data Source:
This study use real money balances as dependent variable, household consumption expenditure (CE), investment expenditure (IE), exchange Rate Volatility (ER), government expenditure (GE) and GDP deflator (P) as independent variables. The time period for the study is from 1972 to 2013. Data for all variables is collected from World Development Indicators (WDI-2014) online database by World Bank.

5. Econometric Methodology:
For this study we used time series data for empirical analysis of Pakistan. It is observed that time series data has unit root problem. To observe the unit root problem Augmented Dickey-Fuller (ADF) is applied which is introduced by Dickey and Fuller (1981). First of all we have tested the stationary level or order of integration of time series that involved in the study by using ADF. Then to test the presence of co-integration among the money demand, household's consumption expenditure, investment expenditure, government expenditure, inflation and exchange rate volatility bounds testing approach based on Auto Regressive Distributed Lag (ARDL) model is used. The ARDL approach is suggested by Pesaran and Shin (1998). ARDL approach is preferred over other available tests of co-integration because results of unit root tests indicate that time series included in the study have mixed order of integration, as some of them are I(0) and others are I(1). The other advantages of this approach include its ability to check for short run dynamics without loss of long run information as this approach is based on the following Unrestricted Vector Error Correction Mechanism (UECM).

6. Empirical Results and Discussion:
This section relates to the empirical results of this study. The table-1indicates the results relating to unit root for all variables of the model. We use Augmented Dickey-Fuller (ADF) test to investigate the stationary level of the variables. The results show that Inflation (GDP deflator), Government Expenditure (GE) and Household's Consumption Expenditure (CE) are stationary at 1(0) whereas M2, Investment Expenditure (IE) and Exchange Rate Volatility (ER) are not stationary at 1(0). But at first difference all the variables become stationary. The overall results of ADF unit root test show that there is mixed order of integration. Thus we use ARDL co-integration which is best for mixed order of integration.

Table-1

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Unit Root Test				
Variables	ADF At level		ADF Ist difference	
M2	0.8601	(8)	-4.273**	(3)
INF	-4.273**	(3)	-7.813***	(3)
IE	-3.495	(4)	-7.361***	(1)
GE	-5.622**	(1)	-3.631**	(6)
ER	1.3442	(6)	-5.8102**	(5)
CE	-5.280**	(1)	-5.466**	(5)
Note: The asterisks *** and ** denote the significant at %1 and 5% levels, respectively.				

ARDL bond testing approach is used to investigate the co-integration among the M2, inflation, consumption expenditures, investment expenditures, government expenditure and exchange rate volatility. The below table-2 indicates the results of the ARDL bound testing approach. The results show that calculated F-statistic is greater the upper bound value of Pesaran et al. (2001) at 5 percent level. This confirms that there exist co-integration among the variables of the model. There is an alternative statistic available in ARDL bound testing approach that is W-statisic. The results show that calculated W-statistic is also greater than the upper bound value at 5 percent. After finding co-integration among the variables of the model now we find the long run and short relationship among the variables of the model. For lag selection Schwarz Bayesian criterion is used and maximum 1 lag length is selected.

Table 2
ARDL Bounds Testing Approach

Dependent Variable M2				
Critical Value	F-Statistics 21.6350		W-statistic 68.6682	
	Lower Bound	Upper Bound	Lower Bound	Upper Bound
95%	2.8056	4.1397	19.6392	28.9781
90%	2.3470	3.5622	16.4291	24.9352

Table-3 indicates the long run results of the study. The results show that inflation has positive and significant relationship with money demand (M2) in Pakistan. The results show that 1 percent increase in inflation increases money demand by 0.5850 percent and this relationship has 5 percent level of significance. The results highlight that investment expenditure has positive and significant relationship with money demand. The results show that 1 percent increase in investment expenditure money demand increases by 0.8365 percent and this relationship has 1 percent level of significance. Government expenditure has negative and significant relationship with money demand. The results show that 1 percent increase in government expenditure decreases the money demand by 0.4805 percent and this relationship is significant at 1 percent level. Exchange rate volatility has negative and significant impact on money demand. The results show that 1 percent increase in exchange rate volatility decreases money demand by 1.1212 percent and this relationship has 1 percent level of significance. Household's consumption expenditure has positive and significant relationship with money demand. The overall results show that inflation, investment expenditure and consumption expenditure have positive and significant impact on

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money demand in case of Pakistan. But government expenditure and exchange rate volatility have negative and significant relationship with money demand in Pakistan.

Table-3

Long Run coefficients

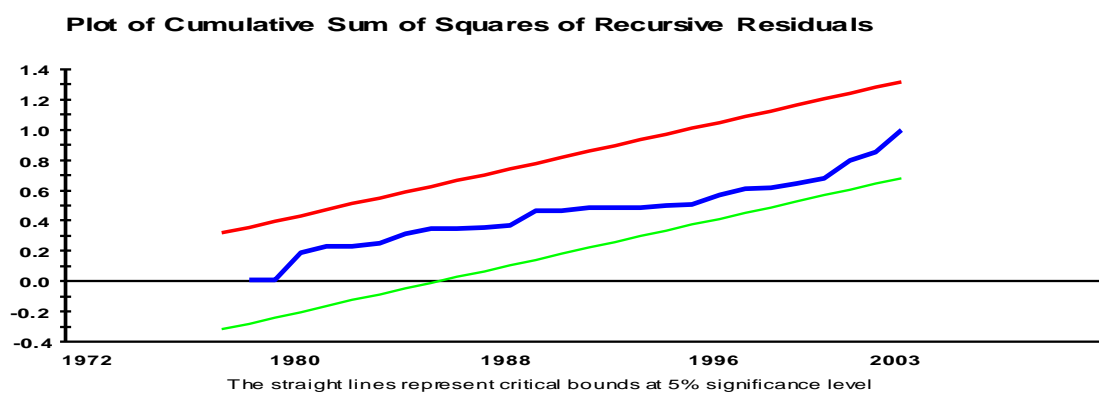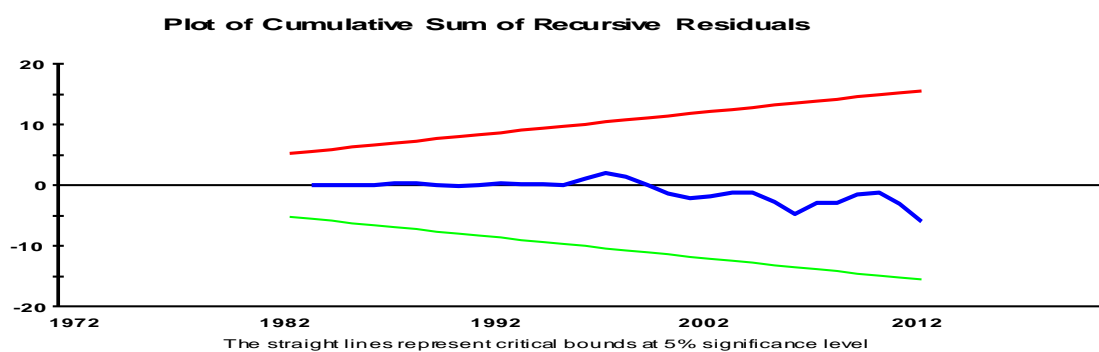| Dependent Variable: M2				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
LnINF	0.5850	2.8109	2.0846	0.044
LnIE	0.8365	0.1020	7.7157	0.000
LnGE	-0.4805	2.7654	-2.8370	0.0081
LnER	-1.1212	2.8609	-3.8961	0.000
LnCE	0.4459	2.7324	2.0631	0.0478
C	4.1810	2.7110	1.5476	0.131
R square 0.999017 Adjusted R-squared 0.998848 Akaike info criterion 52.90211 Durbin-Watson stat 1.98385 Prob(F-statistic)595.124 0.000000				

After finding the long run result among the variables of the model, now we can find the short run dynamic among the variables of the model. Table 4 indicates the short run results of the model. The results show that inflation has positive and insignificant relationship with money demand in Pakistan in short run span of time. Investment expenditure has positive and significant relationship with money demand in short run. Government expenditure has negative and significant relationship with money demand. Exchange rate volatility has negative and significant relationship with money demand and this relationship is same as it is in long run. Consumption expenditure has positive and insignificant relationship with money demand in short run. The value of ECM is negative and statistically significant. The negative value of ECM is theoretically correct which shows the speed of convergence of the short run to the long run.

Dependent Variable = M2			
Variables	**Coefficient**	**Standard Error**	**Ratio[Prob]**
INF	6.8008	1.4609	.46434[.645]
IE	.40606	.08975	4.5332[.000]
GE	-.66459	.10842	-3.8505[.001]
ER	-1.4879	.4897	-3.8505[.001]
CE	.062071	.04249	1.4605[.225]
ECMt-1	-.59755	.09785	-6.1092[.000]
C			

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R-Squared .98593
R-Bar-Squared .98185
DW-statistic 1.6458
F-Stat. 310.635[.000]
AIC = -105.124
SBC = -106.621

Table-4
Short Run Coefficient

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 stability of the long and short run parameters of the model is very necessary and measuring stability Brown et al. (1975) proposed the cumulative sum (CUSUM) and the cumulative sum of squares (CUSUMsq). The cumulative sum (CUSUM) and the cumulative sum of squares (CUSUMsq) are presented in figure-1 and figure-2. The plot of the CUSUM is within the line and significant at 5 percent and the plot of the CUSUMsq is within the line and significant at 5 percent. This ensures the stability of long run and short run coefficients.

7. Conclusion and Policy Suggestion:

The main aim of this study is to investigate the impact of exchange rate volatility and inflation on money demand in Pakistan. For this purpose disaggregate expenditure approach is use in the construction of money demand function. ARDL estimated method use to investigate the co-integration among the M2, investment expenditure, consumption expenditure, government

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expenditure, inflation and exchange rate volatility. The long run elasticities of the independent variables with respect to dependent variables have been calculated. The long run results of the model show that household's consumption expenditures, investment expenditures and inflation have positive and significant relationship with money demand in case of Pakistan. On the other hand the long run results relating to government expenditures and rate of exchange indicate that both have negative and significant relationship with money demand. It is observe that the elasticity of price is less elastic as compared to other coefficients. Similarly the short run elasticties of all above mentioned independent variables have been estimated. The short run estimates indicate that unlike the long run results of household expenditures and inflation become insignificant. On the other hand Investment expenditure has positive and significant relationship with demand for money. The elasticity of government expenditures and exchange rate volatility in Pakistan shows negative and significant association with money demand in the short run. The error correction term ECT shows convergence behavior and it is statistically significant with theoretical correct sign. The estimates of this study may helpful for policy makers to frame stable monetary policy. According to different macroeconomic researcher M2 has critical and significant implications on economic activity and inflation. So, to control and manage money demand its determinants have important contribution. Maybe to frame an effective and consistent monetary policy central bank ought to consider great importance for exchange rate volatility, level of investment expenditure and consumption expenditure as compared to government expenditures. It is possible that the government expenditures might be non-developmental (on defense, subsidies and debt servicing) in Pakistan. But, the investment expenditure and consumption expenditure depict the real picture of economic activity of the country.

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