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The effects of exchange Rate on Money demand: Evidence from Pakistan

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Abstract

The patterns of exchange rate in Pakistan against US. Dollar, following upward trend, affect all the markets in an economy. The households 'purchasing power parity is affected by the effects of exchange rate. This paper examines the long-run and short-run effects of exchange rate on the real broad money demand using times series data from 1972 to 2914 in the case of Pakistan. The Autoregressive distributed lag (ARDL) bounds approach has been employed for achieving the short-run and long-run effects. The result reveals that exchange rate has positive effects in the both long run and short-run. Further, it is found that exchange rate contributes to the stability of model. The results recommend the broad money as a tool for controlling monetary policy in Pakistan.

Keywords: Effects, Exchange Rate, Money, Evidence.

Introduction

Since the Bretton-wood system broke out, the exchange rate has been gaining importance in estimation of money demand function. It has been playing its contributing role in the financial turmoil in the years 1997 and 1998 which resulted in currency devaluation in several economies. Das[1] argued that bubble in housing prices in USA in 2007 led to worst global financial and economic upheaval till 2009, it forced majority of the Asian economies into depreciation of their exchange rates.

Pakistan is one of the open Asian economies that trade with several economies of the world in terms of goods and services. Pakistan is a dollarized economy where majority of the population prefers to save and accumulate US dollar, which reveals the lack of confidence in the domestic currency among the market participants. It is portrayed in Figure 1 that the Pak rupee has been continuously weakening. Furthermore, the upward trend in exchange rate results depreciation with the passage of time. Since Pakistan is highly import-intensive economy, weakening of exchange rate worsens the economic activity in the country. It burdens the economy more for paying their external debts and imports bills to the rest of the world. In addition, the households pay more now as compared previously due to lowering their purchasing power parity. This scenario results in similar trend between exchange rate and monetary aggregates.

This raises question whether money demand in Pakistan is affected by exchange rate. Since the majority of the studies on money demand function that are before the year 2000 employed traditional econometric techniques such as Ordinary Least Squares. They produced spurious results. There are very few studies on money demand function that include exchange rate in Pakistan. Thus, there is need to re-estimate money demand function in Pakistan with new data set and nascent and with efficient econometric technique i.e Bounds Testing Cointegration Approach. Hence, it is imperative to explore the empirical relationship between the demand for money and exchange rate. The remainder of the paper is organized as follows; section two presents the review of related literature. Section three discusses the methodology and data. Section four presents and discusses the empirical results and section six concludes the paper.

Literature Review: Nobel Laureate, Mundell[2] was the first who introduced the significance of exchange rate in money demand, in addition to other traditional variables. In an open economy, mobility of capital and growing foreign trade may influence the stability of money demand function. But he could not produce empirical evidence about the exchange rate. McKinnon[3] showed his advocacy for this channel of effects introducing currency substitution hypothesis which proposed that the external monetary shocks in international financial markets would influence the money demand functions of the countries with flexible exchange rates.

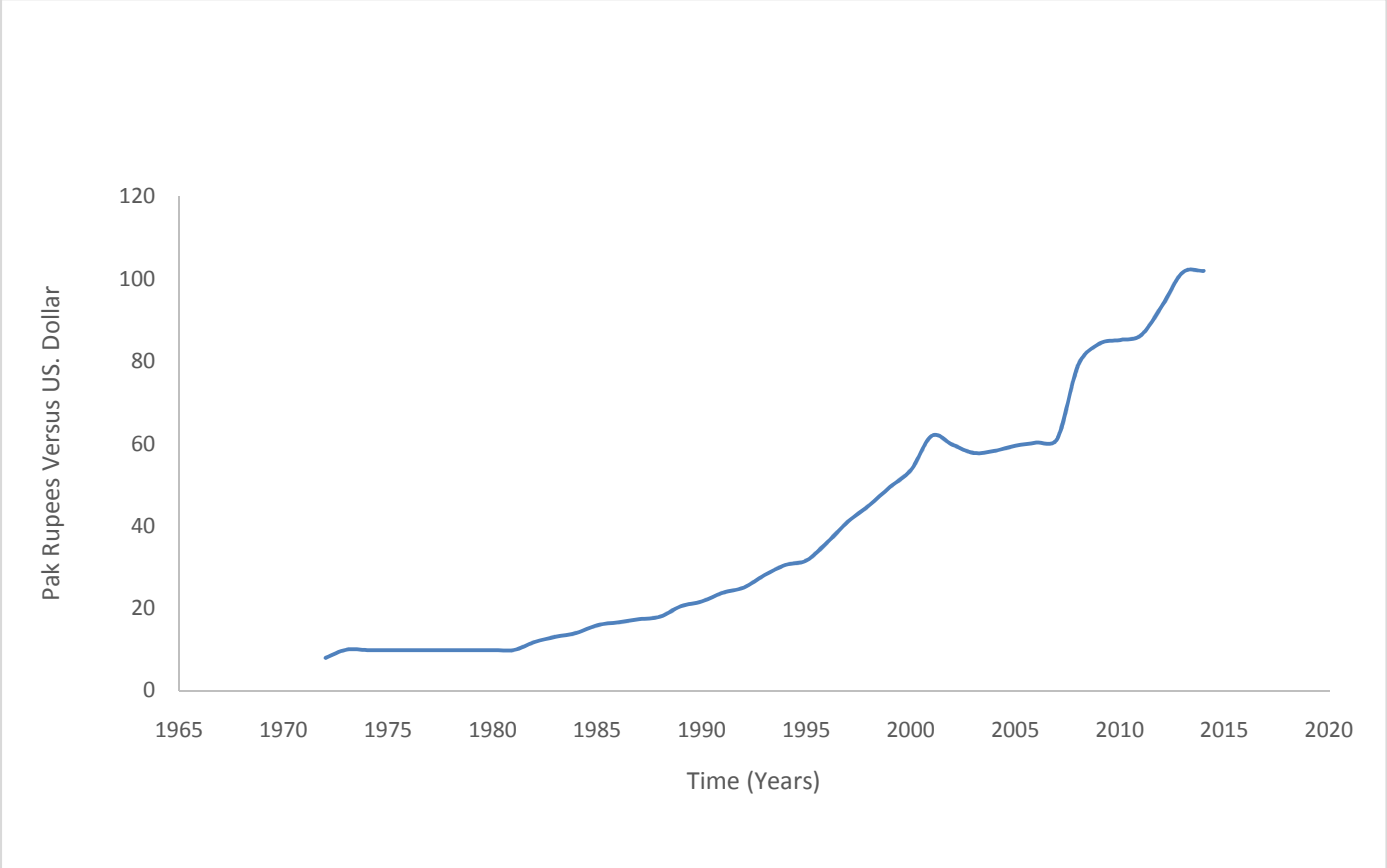
Since the early 1980s researchers have been concentrating the influence regarding monetary developments on function for money demand[3-13]. The exchange rate has empirical findings that divided researchers into two groups due to the impact of monetary developments on the functions for money demand. First, Arango and Nadiri[4] opined about the behavior of exchange rate that domestic currency depreciates (or foreign currency appreciates). It increases the value of foreign assets and rise in the wealth of country and cash balances demand.

This scenario shows that there is positive impact of exchange rate on money demand and it is termed as "Wealth Effect". Second, Bahmani-Oskooee and Pourhedrian[5] pinpointed about the behavior of exchange rate that domestic currency depreciates with further expectations about the future depreciations (or foreign currency appreciates). It increases holdings of foreign currency which diminishes the wealth of country and cash balances demand. This shows that there is negative impact of exchange rate on money demand and it is known as "Currency Substitution Effect".

The impact of variations in exchange rate on money demand in open economy can be seen through the foreign financial sector. According to Arango and Nadiri[4], exchange rate performs a vital role in domestic money demand. Agenor and Khan[14] propose that domestic and foreign money through portfolio shifts gesture for the role of foreign exchange rate variable through substitution effect in the body of literature. On the other hand, there is wealth effect for the exchange rate on money demand is considered due to depreciation of exchange rate with future expectations about depreciation would increase agents' the asset portfolio in terms of foreign securities[5,15,16]. Whereas, many studies do not support to any effect of exchange rate in estimating money demand for both developed and developing countries[17-19].

Since the advent of era of floating exchange rate regime in 1973, the detailed review of empirical work for exchange rate on the demand for money developed and developing countries have been taken into consideration. Money demand model estimated with econometric techniques may remain biased due to omission of opportunity cost of foreign financial sector such as exchange rate. Empirically, several studies have investigated the impact of exchange rate on the demand for money in the developed economies[20,21]. The results have almost remained mixed and ambiguous.

McKinnon[22] furnished the evidence for currency substitution in estimating money demand function for the US. McNown and Wallace[23] also estimated function for demand for money for quarterly data from 1973Q2 to 1988Q4 in the US by employing a cointegration technique developed by Johansen Juselius. They concluded that issue of cointegration in money demand function could be resolved by introducing exchange rate for M_2 but not for M_1. The results supported the wealth effect hypothesis since the coefficient of exchange rate is positively significant.



Source: State Bank of Pakistan

Figure-1
Graph of the Exchange Rate from 1972- 2014 in Pakistan

Arize and shwiff [17] estimated money demands function for Japan using quarterly data from 1973Q1 to 1988Q4 by employing Johansen and Juselius cointegration technique. The results provide sufficient evidence about currency substitution effect with negative and statistically significant coefficient of exchange rate in both long-run and short-run. On the other hand, Bahmani-Oskooee and Wang[24] estimated money demand function for China using quarterly data from 1983Q1 to 2002Q4 with the dynamic modeling econometric approach ARDL for China. The result does not indicate any effect in the long-run as well as Short-run.

Bahmani-Oskooee and Ng[25] estimate the money demand function for Hong Kong with quarterly time series data that covers the period of 1985Q1-1999Q. The independent variables include real income, domestic and foreign interest rate and exchange rate. By employing the Autoregressive Distributive lag model, the results confirmed the hypothesis of currency substitution effect as the coefficient of exchange rate is negative and statistically significant. It is clear from above discussion that there is no any firm conclusion about the specific effect of exchange rate in the estimation of money demand in the developed world.

On the other hand, little account is reviewed to explain the effect of exchange rate in the estimation of money demand in the developing economies. Arzie[26] examined money demand function for the three countries including Pakistan, Singapore, and Korea with quarterly data covering the period 1973 – 1990. He used the Johansen and Juselius cointegration test with income expected inflation, domestic and foreign interest rates, and expected exchange rate as the independent variables. The results provided support that foreign variables have contributory role in money demand function. Lee and Chung[27] examined the money demand for Korea introducing income, net of interest rates, and exchange rate as the independent variables. By using quarterly data covering periods from 1973Q1 to 1990Q4 and employing cointegration technique, they concluded that coefficient of exchange rate is negative and statistically significant hence, supports the currency substitution hypothesis in Korea.

Kogar[28] estimated money demand function for the two countries including Turkey and Israel by using the Johansen and Juselius cointegration technique. He used income, inflation and exchange rate differentials as the exogenous variables. With the inclusion of both inflation and exchange rate in money demand function, narrow money (M_1) and broad money (M_2) are stable in the long run for both countries. His findings proposed that sensitivity of exchange rate in money demand function signals for support of the currency substitution hypothesis in both Turkey and Israel. The results also show the long-run relationship supporting the stability of money demand.

Darat and Mutawa[29] examined money demand function for United Arab Emirates (UAE) with time series that ranges over 1974Q1-1994Q2, incorporating independent variables; non-oil real gross domestic product, expected inflation, domestic and foreign interest rate, and exchange rate. A "koyk" Partial adjustment Scheme was applied and their empirical findings showed a statistically significance for the negative coefficient of exchange rate at 10% signaling a weakness toward the hypothesis of currency substitution in UAE.

Tan[7] estimates function on money demand for Malaysia using quarterly data from 1973Q1 to 1991Q4. By employing Johanson cointegration analysis and general to specific approach, the results report that the coefficient of exchange rate is negative and statistically significant showing effect on only (M_1) real balances of narrow money demand but not (M_2) Broader one. Thus study supports the currency substitution hypothesis. Mohammad *et al*.[30] also examined the empirical study on money demand for Malaysia. The results of the study did not support to any hypothesis. Moreover, Ibrahim[9] estimated money demand function for Malaysia and found the exchange rate with negative effect on function for money demand. He further concluded the dominancy of wealth effect hypothesis on money demand showing the coefficient of stock prices as a statistically significant.

Weliwata and Ekanayake[8] examine money demand for Sri Lanka using quarterly data from period 1978Q1 to 1994Q4. By employing Johansen-Juselius cointegration and error correction analysis, results report that the coefficient of exchange rate is negatively related to M_1, the real cash balances and is statistically significant. They further proposed that relationship for M_2 with exchange rate remains indecisive. The exchange rate exerts an enough amount of bearing over domestically money demand due to openness of Asian economies to the rest of the world. Besides to this, Jayasooriya[31] also estimated a study on demand function for Srilanka using time series annual data from the period 1960 to 2007. He used a dynamic model VAR cointegration approach, including real output, interest rate, exchange rate, and minimum wage as the exogenous variables. Results of the study portray that the coefficient of exchange rate is negative but statistically insignificant with monetary aggregates. Author interpreted the pragmatic evidences regarding the fluctuations in exchange rate and minimum wage rate should be adjusted with changes in money demand because they make the economic shocks and money demand vulnerable and insecure respectively.

Randa[32] estimated money demand function for Tanzania with quarterly data that cover the period 1974Q1-1996Q4. By employing Johansen's maximum likelihood and dynamic modeling procedure, the results support the currency substitution hypothesis concentrating on the stability of standards of monetary aggregates; M_0, M_1, and M_2.

Civcir[33] examined the study on money demand functions for Turkey with income, inflation, interest rate and expected exchange rate as the independent variables. By employing

Johansen's cointegration analysis, the results emphasize for the incorporation of exchange rate as determinant of money demand and support the currency substitution hypothesis in Turkey. Besides this, Bahmani-Oskooee and Karacal[34] also estimated money demand function for Turkey using time series monthly data that covers the period from 1987M1 to 2004M6. By employing an ARDL Bound test with income, inflation, interest rate, and exchange rate as the exogenous variables and narrow and broad money aggregates as the endogenous variables, findings of study witness the presence of currency substitution hypothesis hence, the coefficient of exchange rate is negative and statistically significant.

Bjornland[35] estimated money demand function in Venezuela. He used the quarterly time series data covering the period 1985Q1-1999Q1 with real income, price level, and interest rate on domestic assets inside the country, interest rate on domestic assets outside the country, foreign interest rate, and exchange rate as the independent variables. By employing the Johansen and Juselius cointegration analysis, the results confirm that domestic currency would be demanded less due to expected depreciation in the long-run signaling support to currency substitution hypothesis.

Bahmani-Oskooee and Wang[24] examined a study on money demand in china incorporating real income, domestic and foreign interest rates, and exchange rate as the exogenous variables. By using Quarterly time series data over the span of 1983Q1-2002Q4 and employing an ARDL bound test, the findings concludes that exchange rate is negatively affecting both money aggregates M_1 and M_2. But it is statistically insignificant at conventional significance level showing the weak evidence for currency substitution.

Sharif-Renani[16] conducted study on money demand for Iran time series annually data from 1985 to 2006. By employing an ARDL technique with output, inflation and exchange rate as the independent variables over monetary aggregates, the results reveal that coefficient of exchange rate is positive and statistically significant with only M_1 supporting the wealth effect hypothesis in the economy of Iran.

Valadkhani[36] estimated a study on money demand for the six countries including China, Japan, Malaysia, the Philippines, Singapore, and Fiji. He used the annual time series data over the time span of 1975-2002 with real output, inflation rate, interest rate, exchange rate, and US interest rate as the independent variables and the monetary aggregates as dependent variables. By employing a standard least square based technique Engle-Granger, two steps procedure, the results report the statistically insignificant coefficients of the exchange rate and foreign interest rate with negative sign signaling the support for the currency substitution hypothesis and capital mobility hypothesis in the long-run for all the six countries.

Abdullah, Ali and Matahir[37] estimated money demand function for the five ASEAN countries consisting Thailand, Malaysia, Singapore, Indonesia, and the Philipines. By employing an ARDL cointegration procedure, the results of the sampled data reveal that coefficient of exchange rate is positive and statistically significant signaling the support for the wealth effect hypothesis in all the six countries. Moreover, Yilmaz, Oskenbayev and Kanat[38] also estimated empirically money growth function for Kazakhstan introducing GDP, interest rates, and real effective exchange rate an exogenous variables. The results of the study reveal that the estimated coefficient of exchange rate is negative and statistically significant supporting currency substitution hypothesis in the estimated money demand.

Dritsaki[39] examines money demand function for Hungry using quarterly data from the period 1995Q1 to 2010Q1 introducing income, inflation and exchange rate as the exogenous variables and M_1 and M_2 as the endogenous variables. By employing an Autoregressive distributed lagged (ARDL) Bound test, author reports that the coefficient of exchange rate is statistically significant and negatively affecting the both M_1 and M_2 witnessing the existence of currency substitution hypothesis in Hungry.

Sahadudheen[40] conducted study on money demand function for India dealing with time series data that covers the period of 1998Q1-2009Q2 with real income, interest rate, and real effective exchange rate as the independent variables. By using Johansen and Juselius cointegration technique, it is found that the coefficient of exchange rate is negative and statistically significant confirming the existence of wealth effect hypothesis in India.

Arize and Nam[12] estimates the money demand function for the seven countries comprising Pakistan, India, Srilanka, Thailand, Malaysia, Philippine, and Korea with income, interest rate, and exchange rate as the independent variables and (M_1) narrow and (M_2) broad monetary aggregates as the dependent variables. The Quarterly time series data were used from the period 1977Q1 to 2009Q4. By employing panel cointegration technique, results confirm that the coefficient of exchange rate is positive and statistically significant hence, the wealth effect hypothesis is supported in all the seven countries.

Bahmani-Oskooee and Bahmani[41] conducted study on money demand function for Korea making use of the annual time series data that holds the period of 1971-2010 with interest rate, exchange rate and volatility of exchange rate as the exogenous variables. By employing an ARDL cointegration procedure, findings signal to support the currency substitution hypothesis in Korea on the basis of positive and statistically significant coefficient of exchange rate.

Furthermore, in context of Pakistan the empirical results of exchange rate in money demand are not in harmony. Different

studies produce different results; for example Hossain[43], Bahmani-Oskooee and rehman[43], Azim *et al.*[42], and Anwar and Asghar[13] support for the currency substitution hypothesis. On the other hand, Khan and Sajjad[44] confirm the evidence of wealth effect hypothesis.

Empirical studies in the body of literature conducted on money demand in both developed and developing economies of the world provide conflicting evidence about the relationship between exchange rate and the money demand. However, these studies do not validate a firm conclusion such as hypothesis of currency substitution effect, wealth effect or neither. There is dire need to study exchange rate in money demand hence, it is included in this paper for further analysis in case of Pakistan. Since the sample size differs from the previous studies in terms of time frame so, it is not expected for the same results as mentioned above.

Methodology

Following Bahmani-Oskooee[45] and Bahmani and Bahmani-Oskooee[41], the model for money demand takes the following form:

$$LnM_t = b_0 + b_1 LnY_t + b_2 Lni_t + b_3 Ln\pi_t + b_4 LnRER_t + \varepsilon_t. (1)$$

Where, this model explains the money demand for Pakistan. In this model, the dependent variable is the broad money supply (M), the gross domestic Product (Y), the discount rate(i), the inflation rate (π), and the exchange rate (RER) are independent variables in the above model. The expected signs of the coefficients of independent variables in equation (1) are as follows.

$$b_1 > 0, b_2 < 0, b_3 < 0, and\ while\ b_4\ may\ be\ positve\ and\ negative.$$

Generally money demand function is specified as a function of real balances, imposing price homogeneity in the model. There are severe econometric caveats using nominal money balances rather than real money balances as a response variable[46]. In this model, (M2) is the broad nominal monetary aggregate which is sum of narrow money (M1) and the quasi money. It is deflated by GDP deflator for year the 2006 to obtain broad real money (LNM2). All the variables in this model are expressed in terms of natural logarithm.

LNY is real income and is measured as real gross domestic product expressed in million rupees at constant price for year the 2006. Since the effects of increase in the real income on the domestic money demand can be signed by doing comparative statics on equation (1). Particularly, $b_1>0$ means increase in the real incomes raises the number of transaction in the economy that leads to increase quantity of money demand theoretically. Therefore, it is expected to be positive relation with money demand.

The opportunity cost of holding money stock is termed as interest rate. The proxy of domestic interest rate is taken as bank discount rate (LNI). Majority of the rates depends upon it because it is issued for other banks by State Bank of Pakistan. Since the increase in the discount rate can be signed by making comparative statics on equation (1). Specifically, $b_2<0$ means increase in discount rate raises the opportunity cost of holding domestic money and then lowers the amount of holding money. Thus the expected sign of discount rate is negative with money demand. Inflation rate is a persistently substantial change (continuous rise) in price level in the overall economy. GDP deflator is used as proxy to find inflation rate and defined as follows:

$$\frac{\text{GDP Deflator(t)} - \text{GDP Deflator (t} - 1)}{\text{GDP Deflator (t} - 1)}$$

Where GDP-Deflator (t) is the current year's GDP-deflator and GDP-Deflator (t-1) is the previous year's GDP-Deflator. It is used in the model as (π). The effects of increase in general price level can be signed by comparative statics on equation (1). Particularly, $b_3<0$, means increase in the price level raises the opportunity cost of holding money and then lower the amount of domestic money. Since it has theoretically negative relationship with money demand so its sign is expected as negative.

Real Exchange Rate (LNREX): The exchange rate defined as number of units of Pak rupees per U.S. dollar. This reveals that depreciation of domestic currency reflects an increase. The nominal exchange rate is converted into real exchange rate by $RER = \frac{EX*p^*}{P^d}$. Where: EX is the nominal exchange rate of Pakistan versus US dollars. P^* is the price level in US and P^d is the domestic price level in Pakistan. However, the sign of real exchange rate cannot be determined on the domestic money demand. It is positive or negative. The negative sign is an indication of increase in exchange rate reduces the domestic money demand, supporting the hypothesis of currency substitution while, positive sign means increase in real exchange rate increases the domestic money demand further, supporting to Wealth effect hypothesis.

The ARDL Bound Testing Approach: To achieve the main objectives, the autoregressive distributed lag (ARDL) Bound Testing approach has been used which is a modern cointegration technique for examining long-run and short-run relationships between dependent and independent variables under the analysis. This approach is appropriate for small sample size and statistically significant for examining cointegrating relationships in the samples, whereas Johansen cointegration approach needs large sample size for valid findings[47]. All cointegation approaches follow all independent variables to be of the same integration order but ARDL does not demand so. It cancels all pretesting for standard cointigration tests[48]. Moreover, the ARDL is possible for same number of optimal lags, while it is impossible for other traditional techniques.

In this paper, it is pondered the nascent empirical procedures for examining effect of exchange rate on money demand. It is assumed that money demand is being examined by explanatory determinants such as the gross domestic product (Y), the interest rate (i) which is discount rate of the central bank in Pakistan, the inflation rate (π), and the real exchange rate (RER).

All variables under study are described in the form of natural logarithmic notation (Ln). The ARDL model described by Pesaran *et al.*[48], takes the form as:

$$\Delta LnM_t = \alpha_0 + \sum_{i=1}^{q_1} a_i \, \Delta LnM_{t-1} + \sum_{i=1}^{q_2} c_i \, \Delta LnY_{t-1} + \sum_{i=1}^{q_3} d_i \, \Delta Lni_{t-1} + \sum_{i=1}^{q_4} e_i \, \Delta Ln\pi_{t-1} + \sum_{i=1}^{q_5} f_i \, \Delta LnRER_{t-1} + \rho_0 LnM_{t-1} + \rho_1 LnY_{t-1} + \rho_3 \pi_{t-1} + \rho_4 LnRER_{t-1} + \mu_{1t} \quad (2)$$

The parameter , where ρ_j j=1, 2, 3, 4 portrays long run effects for corresponding variables normalized by ρ_0 , meanwhile the a_i, c_i, d_i, e_i, and f_i the indicators of money demand in Pakistan depict short-run effects for ARDL model. In ARDL model null hypothesis is stated as (i.e.$H_0: \rho_1 = \rho_2 = \rho_3 = \rho_4 = 0$), describing no co-integration) is examined by calculating an F-statistic for all variables expressed in terms of log. Afterwards, one has to compare calculated F- value with the tabulated value prepared by Pesaran *et al.*[48].

If calculated F value falls in the right of upper bound the no cointegraiton null hypothesis is rejected, whereas, if it falls below the lower bound it is not rejected. Finally, the result makes indecisive if it is between the bounds.

Equation (2) has been estimated without the ECM term in start, whereas later it is inculcated in ARDL model as in equation (3)

$$\Delta LnM_t = \alpha_0 + \sum_{i=1}^{q_1} a_i \, \Delta LnM_{t-1} + \sum_{i=1}^{q_2} c_i \, \Delta LnY_{t-1} + \sum_{i=1}^{q_3} d_i \, \Delta Lni_{t-1} + \sum_{i=1}^{q_4} e_i \, \Delta Ln\pi_{t-1} + \sum_{i=1}^{q_5} f_i \, \Delta LnRER_{t-1} + \gamma (ECM)_{t-1} + \mu_{1t} \quad (3)$$

Data: The data set ranges from 1972 to 2014 (43) taken from the various reports of State Bank of Pakistan, Pakistan Statistical Bureau, Pakistan Economic Survey, IFS and WDI CD ROM, 2014 pertaining to IMF and World Bank respectively. All data are expressed in domestic, international ($US) currency and unit less. All the variables are expressed in terms of logarithms (Ln). The dependent variable includes broad money demand only and independent variables enlist the real income, interest rate (discount rate), inflation, and real exchange rate.

Empirical Results

There is no need to check the stationary about the variables in this paper but just is checked for stationarity due to time series by confirming non availability of I(2) as an integration order.So, Augmented Dickey Fuller (ADF) test is applied to examine the stationarity at level and first difference for all the data series in this paper.

Results reported in Table-1 show that discount rate (LNI), inflation rate (LNπ) are stationary at level. While, real broad money demands (LNM2), real income (LNY), and real exchange rate (LNRER) are stationary at first difference. Since there is mixture of results of stationary for all the variables in this paper. There is no any variable stationary at second difference.

This glimpse of stationarity results in Table-1 is appropriate and allow us to employ the Autoregressive distributed lagged (ARDL) bounds testing approach. The maximum three lags on each first-differenced variable are imposed due to small number of observations.

Knowing the advantage of Hannan-Quinn Criteria (HQC) over others, optimum lags have been selected and results are reported in the Table-2 for the optimum model for real broad monetary aggregates (LNM2) in Pakistan.

Table-1
Stationary Results of Augmented Dickey Fuller (ADF) Test Statistics for Data (1 972-2014)

	Level		**First Difference**	
	C	**C+T**	**C**	**C+T**
LNM2	-0.35	-2.25	-5.05***	-4.99***
LNY	-0.37	-1.17	-6.56***	-6.81***
LNI	-3.12**	-3.24*	-4.54***	-4.44***
Lnπ	-4.49***	-3.45*	-7.66***	-7.56***
LNRER	-1.05	-0.45	-4.81***	-4.79***

Note: 1. *, **, and *** show the results significance at the level of 10%, 5%, and 1% respectively.

The framework of cointegration in the bounds test compares the F-statistics against the critical values in the tables of Peasran *et al.*[49] and Narayan and Narayan[50] for the specific sample sizes. The bound test for the real broad monetary aggregates (M_2) in in the Panel-A of the Table-3. Using the asymptotic critical value computed by Peasaran *et al.*[49] and Narayan and Narayan[50], it is found that test statistic is significant at 1% level for M_2. The result leads to reject the null hypothesis of no cointegration irrespective of order of integration. Since the computed values of F for M2 is 96.834 which is greater that upper bounds of 5% and 1% level of significance. So, it provides evidence about the presence of valid long-run relationship between the both monetary aggregates and set of independent variables in Pakistan.

After establishing long-run relationship between dependent and independent variables in ARDL model, long-run and short-run elasticities are computed and results are reported in Panel-A and B of the Table-2. Lag selection criterion is an important issue in ARDL model. The best performing ARDL model depends upon the significance of VECM parameters. The Hannan-Quinn Criteria (HQC) are relatively more preferred for model specification because it tends to define parsimonious specification clearly the current study prefers it due to small sample size[50].

As the results reported in the Panel A and B of the Table-2 show that exchange rate (LnRER) is positively related to M2 and remains statistically significant at 5% level of significance in the short-run and long-run. The exchange rate elasticity of money demand is 1.609, showing one percent change in exchange rate leads money demand to increase by 1.6 percent in the long-run. It is elastic and supports the wealth effect hypothesis in the Pakistan, holding foreign currency more than the domestic currency due to future expectation for the further depreciation in the domestic currency. The results of this paper differ from the previous studies conducted on money demand[13,10,42,43] including exchange rate that supported currency substitution hypothesis in Pakistan.

Panel-A and B of the Table-2 reveal the results that the long-run coefficients for Equation (2) follow a similar pattern. The results show that for M2, income (LnYt) variable is positively related and statistically significant in the long-run only but remained insignificant in the short-run in Pakistan. However, we found that income (LnYt) is positively related and significant in the long-run at the level of significance 1% (due to one percent rise in real income real broad money supply

Table-2
ARDL (2, 2, 3, 0, 3) Model for Broad Money Demand in Pakistan

Panel-A: Short-Run Effects

	Lag Order				
	0	**1**	**2**	**3**	**4**
ΔLnM2		0.341			
		(2.338)**			
ΔLnY	0.010	-0.014			
	(1.757)*	(0.017)**			
ΔLnI	-0.057	-0.111	0.247		
	(-0.523)	(-0.814)	(2.334)**		
ΔLnπ	-0.074				
	(-2.347)**				
ΔLnRER	0.193	0.372	-0.412		
	(0.938)	(1.527)	(-2.581)**		

Note: 1. *, **, and *** show the results significance at the level of 10%, 5%, and 1% respectively.

Panel-B: Long-Run Effects

Constant	LnY	LnI	Lnπ	LnRER	ECM(-1)
17.461	0.077	-0.630	-0.442	1.609	-0.168
(9.744)***	(3.263)***	(-1.305)	(-1.567)	(7.849)***	(-2.376)**

Note: 1. *, **, and *** show the results significance at the level of 10%, 5%, and 1% respectively.

Should be increased only by seven basis points) but remains insignificance even at 10% level of significance in the short-run.

In addition, both of the interest rate (LnI) and inflation rate (Lnπ) hold expected signs according to economic theory. Both of them are statistically significant in the short-run while statistically insignificant in the long-run with broad monetary aggregates even at 10% level of significance, showing interest rate and inflation are short-run phenomenon.

The long-run effects would be only meaningful if cointegration or joint significance of lagged variables is established in equation (02). Since the ECM term shows the speed of adjustment in restoring equilibrium in the dynamic ARDL model. Error correction term for M2 is described in Panel-B of the Table-2. The ECM coefficient shows how quickly variables return to equilibrium and it should be statistically significant coefficient with a negative sign. As above discussed, the coefficient of ECM (-1) for M2 is -0.168 and statistically significant at the level of 5% which describes that every year equilibrium is corrected by the speed of 17% for M2 through the set of independent variables such as income, interest rate, inflation rate, and exchange rate which is slower speed toward equilibrium.

To ascertain the goodness of the ARDL model, the diagnostic test and the stability test were conducted. The Panel-A of the Table 3 depicts that all tests such as Ramsey RESET stability test, Jarque Bera Test for normality, ARCH Test, and the Breusch-Godfrey Serial Correlation LM test are passed by the model that shows no indication of autocorrelation. As for stability of parameters is concerned, the Figure-2 shows that model does not cross the band lines in the CUSUM and CUSUMQ tests. In other words, it provides sufficient evidence that the model for M2 is stable and can be used as policy purposes.

Table-3
Battery of Diagnostics and Stability of the parameters in the Model

Panel-A: Battery of Diagnostic Test

Bounds Wald Test	RESET	Normality	ARCH-Test	LM
96.834 (0.000)***	1.889 (0.071)	1.988 (0.370)	0.244 (0.362)	10.28 (0.566)

Note: The values in parentheses are absolute t values in Exihibit-A and B and pvalues in Exihibt-C. The upper bound critical value is 3.5 for the F statistics in Pesaran *et al.*[48], Table CI-Case III, p. 300 at 5%. RESET is Ramsey's specification test. It follows χ^2 distribution with one degree of freedom.3.84 is the CV at 5%. ARCH Test is for Homoskedasticity of residuals with χ^2distribution with one degree of freedom.3.84 is CV at 5%. LM is the Lagrange multiplier test for serial correlation with χ2 distribution with four degrees of freedom.9.48 is the critical value at the level of significance 5%.

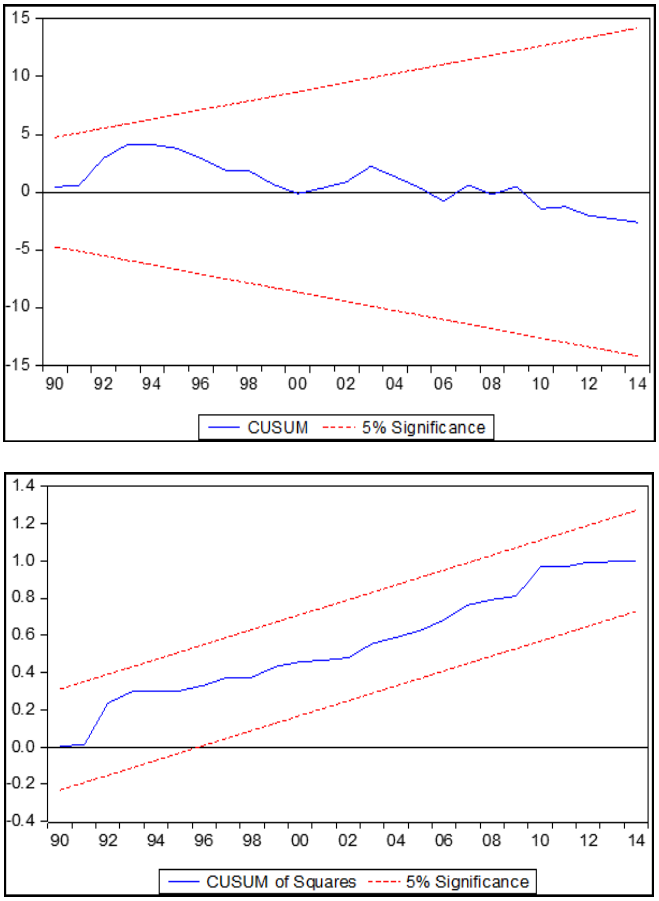


Figure-2
CUSUM and CUSUMQ Plots for M2

Conclusion

A Nobel Laureate, Robert Mundell[2] proposed the idea to include exchange rate in estimating money demand function besides the scale variable (income) and opportunity cost of holding money (interest rate, inflation rate).

Following the suggestion of Arango and Nadiri[4], exchange rate has been included in case of Pakistan using annual time series data ranging from 1972 to 2014. It has been concluded that exchange rate has statistically significant long-run and short-run effects with real broad money demand, supporting the wealth effect hypothesis. It also contributes in the stability of real broad money demand function in Pakistan. Therefore, broad money supply should be used to control monetary policy in Pakistan reducing exchange rate hence, enhancing the belief of agents in the holding of domestic currency rather than foreign currency. If the trend of decline in the holdings of the domestic currency continues, it can results a slowdown in the economy, worsening the economic crisis in the Pakistan.

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