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MONEY DEMAND FUNCTION REVISITED: THE ROLE OF ASSET PRICES IN PAKISTAN

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Abstract. Money demand function has always been an important constituent of the macroeconomic models and policy making. A stable money demand function is crucial for the efficient conduct of monetary policy which enables the policy makers in forecasting, policy analysis and choosing a nominal anchor. From 1980s onwards, questions were raised on the stability of money demand function and varying explanations were provided for the instability both internationally and in Pakistan, but the research in this area never remained conclusive. However, this study is the first attempt to prove that money demand function in Pakistan is mis-specified without incorporating asset prices in its estimation. The study, therefore, contributes to the existing literature on the issue of stable money demand function in Pakistan by using asset price index to explain the money demand in a multivariate regression model and VECM for the time period 1981Q1-2017Q2. The study concludes that asset price index plays a significant role in explaining variation in money demand and the relationship is found positive. Moreover, results of the individual asset prices show that prices of two assets, housing and share prices, via positive wealth effect, lead to an increase in the demand for money balances in Pakistan. These results imply that previous studies finding instability of money demand function are mis-specified without asset prices

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I. INTRODUCTION

State Bank of Pakistan (SBP) used monetary aggregate as policy target for the conduct of monetary policy in Pakistan till 2008, whereby the narrow monetary aggregate M0 was used as instrument to target broad monetary aggregate such as M2 – used as a nominal anchor to achieve the objective of price stability and output growth. However, from 2009 onwards, SBP adopted interest rate targeting by introducing an interest rate corridor and using overnight money market repo rate as its operational target. This regime switch was due to the apparent unstable relationship between inflation and money supply and an unstable money demand function because of the structural changes in the economy and the financial sector of the country, fiscal pressure, financial innovation and increasing use of technology [Hanif, 2014; Omer & Saqib, 2009; Moinuddin, 2009; MPS-SBP, 2009].

The available literature on interest rate versus monetary targeting in Pakistan presents differing views on the adoption of a particular strategy. Many studies found a positive and significant relationship between money supply and inflation in Pakistan [Hanif & Hayat, 2016; Farooq, Hassan, Shahid, 2015; Qayyum, 2006, Kemal, 2006] and found stable base and broad money velocities (Omer, 2010). Moreover, it is also suggested to consider money in the models of the Pakistan economy because all the monetary aggregates are strongly pro-cyclical and a few of them even serve as the leading indicators of economic activity and also cash based models along with money growth rule perform better in data matching than the cashless economy models with Taylor type rule (Ahmed et al, 2016). This line of research provides evidence for the use of monetary aggregates targeting for Pakistan to contain inflation but the excessive focus on the interest rate targeting has reduced the role of monetary targeting. However, it has also been proved that quantity theory of money is not applicable in Pakistan along with unstable income velocity of money, which casts doubt on the use of monetary aggregates targeting (Omer & Saqib, 2009).

The monetary aggregate targeting also received criticism due to the upsurge in inflation in Pakistan along with the success stories of inflation targeting regimes followed by various countries. The stable growth in monetary aggregates led to instability in the price behavior due to the shocks to money demand and an unstable transmission mechanism. This led policy makers to resort to fine tune the aggregate demand through interest rate management (Felipe, 2009). The instability of the money demand function also led policy makers to prefer inflation targeting over monetary targeting. An inflation targeting monetary policy requires commitment to price stability, independent and transparent central bank, flexible exchange rate and fiscal discipline. This debate over inflation targeting led to the research in Pakistan that focused on the argument for and against the adoption of inflation targeting in Pakistan [see for instance, Moinuddin (2009), Felipe (2009), Akbari and Rankaduwa (2006), Khalid (2006), Khan and Schimmelpfennig (2006), Chaudhry and Choudhary (2006)].

A stable money demand function is crucial for the efficient conduct of an appropriate monetary policy which enables the policy makers in forecasting and policy analysis. The accurate forecast of money demands helps in determining the optimum growth rate of money supply which is important in controlling inflation rate in the economy and also because money supply can have predictable effects on real economic variables. Moreover, a stable money demand function is important for monetary and fiscal policies to have predictable effects on the macroeconomic variables.

The existing literature has identified various sources of instability in money demand function such as structural changes in the economy, financial innovation and deregulation, unexpected changes in the income velocity of money, changes in the relationship between money stock and other fundamental macroeconomic variables such as income and interest rate, discrepancies between money supply and money demand etc. Many studies have worked on the estimation of money demand function and its determinants in Pakistan such as Rehman and Afzal (2003), Qayyum (2005), Khan & Sajid, (2005), and Hye et al., (2009). The studies specifically focusing on the stability of money demand function in Pakistan proved its stability [Sarwar (2010); Omer (2010)], or concluded otherwise (Moinuddin, 2009).

This study contributes to the existing literature in Pakistan on the issue of stability of money demand function by explaining it with the inclusion of asset prices in the money demand function as the existing models of the money demand are mis-specified in this respect. The inclusion of asset prices solves the problem of unstable money demand function and improves the stability and economic properties of the function as well (Borio, Kennedy & Prowse, 1994). This aspect of including asset prices in the money demand function can be understood from the Keynesian liquidity preference theory in which money is also demanded to invest in interest bearing bonds to earn profit through speculation. However, interest rate is not a true indicator of assets such as stock prices or real estate as it is an indicator for bank deposits and T-bill rates. Therefore, the need is to bring asset prices directly into the money demand function to prove its stability properties.

With this context, the objective of this study is to participate in the debate on (un)stable money demand function by estimating the money demand function for Pakistan with the inclusion of asset price indices. The present study also aims to analyze the effect of separate asset prices such as house prices, stock prices and exchange rate on the demand for money. The empirical evidence we tried to find is important for Pakistan economy where rent-seeking activities have higher weight in overall economic activity compared to that of entrepreneurial activity.

To accomplish this objectives, we have used multivariate regression analysis and vector error correction model for the estimation of the role that asset price indices play in explaining the money demand function for the time period 1981-Q1 to 2017-Q2. It has been found that the asset prices play a significant role in explaining the money demand function in Pakistan and the relationship is found positive. Moreover, an increase in the housing and share prices via positive wealth effect leads to an increase in the demand for money balances in Pakistan.

Remainder of the study proceeds as follows: In section 2 we discuss the review of existing literature on the topic. Section 3 discusses the econometric methodology used for the estimations and in section 4 the results of the study are discussed. Section 5 concludes the study.

II. LITERATURE REVIEW

THEORIES OF MONEY DEMAND

There are five major approaches to theorize money demand function. First, the classical economists, who never explicitly formulated a demand for money theory, stressed on 'transactions velocity of circulation of money' in the Fisher's (1911) Quantity theory of money and equation of exchange i.e. MV= PT. The equation of exchange states that the total amount of money in circulation in the economy equals the value of transactions undertaken in the economy. Money performs the medium of exchange function only and facilitates the exchange of goods and services. Moreover, transactions demand for money is determined by the full employment level of income. The strict version of the quantity theory has certain interrelated propositions. First is the exact proportionate relationship between the money stock and price level for which the stability of the money demand functions is imperative. The second proposition is that the changes in money supply cause changes in the price level, that is, the causation runs from money (M) to price level (P). Third proposition is of the neutrality of money, which implies that changes in the money supply have no effect on real variables such as output and employment. Fourth proposition states that money is the only determinant of the general price level in the economy and the price level is not affected by the non-monetary factors. Fifth, the money supply is exogenous and it is not determined by the changes in demand for money (Humphrey, 1974).

Second, Keynes (1936) formulated the "liquidity preference theory" of money demand and suggested three motives of demand for money. Firstly, the transactions demand for money arises from the need for cash for the current transactions of personal and business exchanges and it is proportional and positive function of the level of income. Secondly, the precautionary demand for money which is held for sudden expenditures and unforeseen circumstances is also a positive function of the level of income. Thirdly, the speculative demand for money, which is money held as a liquid store of value to be invested in interest bearing bonds at an opportune moment and take advantages of market fluctuations. The speculative demand for money is a negative function of the rate of interest. As the interest rate increases the opportunity cost of holding

money increases and people prefer investing in bonds, therefore, demand for money decreases.

Third, Tobin's portfolio approach to demand for money based on risk aversion theory of liquidity preference. Tobin (1956) formulated that people kept a portfolio of assets consisting of money and interest bearing bonds. An investor can be faced with the problem of balancing the two components i.e. how much of his portfolio of assets should be kept as interest bearing bonds which offer him higher average return with higher risk and how much as money with zero returns. Tobin made demand for money a negative function of the rate of interest as higher compensation for not holding money overweighs shoe leather cost.

Fourth, Baumol's inventory demand for money approach which views money as an inventory held for transaction purposes. According to Baumol (1952), like businessmen, consumers also hold inventory of money in order to facilitate the transactions of goods and services. By holding money people bear a cost in terms of interest rate foregone, which they would have earned if they have kept this money in saving deposits, time deposits and interest bearing bonds. In this way Baumol and Tobin highlighted that transactions demand for money is not independent of the rate of interest as was formulated by Keynes.

Fifth, Friedman's demand for money theory (1956) makes demand for real balances a function of individual's wealth, expected return on money, bonds and equity and the expected rate of inflation.

STABILITY OF MONEY DEMAND FUNCTION

As mentioned before, the stability of money demand function is imperative for the successful conduct of monetary policy in terms of having predictable effects on output, interest rate and the price level in the economy. A stable money demand function has three key elements in it. First, it should possess a highly predictable demand for money relation that can be measured by its goodness of fit, precision of the estimated coefficients and its ability to make accurate out of sample forecasts. Second element requires demand for money function to have fewer arguments because it becomes less predictable if it requires knowledge about a large number of variables. Third, the arguments of money

demand function should have important links to spending and economic activity in the real sector (Judd & Scadding, 1982).

Research prior to 1973 provided evidence for the stability of money demand function. However, from mid 1970s and early 1980s the money demand function experienced a shift and it was questioned for its stability properties. Various explanations were given for the instability of the money demand function, in particular, two approaches were adopted. First, efforts were made to test the alternative explanatory variables that can explain the change in the money demand function. Second effort to correct the demand for money function was to redefine money. But none of the efforts could improve the forecasting ability of the money demand function (Duprey, 1980). Anderson (1985) highlighted three major sources of instability. First, changes in the income velocity of money in response to variations in interest rate and other arguments of the money demand function which are independent of the changes in income. Second, the money demand function may shift due to unstable parameters, financial innovations and deregulation that can change velocity unexpectedly due to changes in interest elasticity of monetary aggregates and also the balances that are held at each interest rate. Third, the short run mismatch between money stock held and money demand desired can induce large and unexpected changes in velocity and the money demand function may appear unstable.

ASSET PRICES AND MONEY DEMAND

Borio, Kennedy & Prowse (1994) highlighted that the setting of monetary policy has been complicated by the collapse of the traditional demand for money functions that relates monetary aggregates to the price level, real income and interest rates. The inclusion of the asset prices helps to solve the mystery of declining velocity and unstable money demand function and it significantly improves the stability and economic properties of the relationship for several countries, which experience the major structural changes taking place in the financial system. Because a higher value of financial and real transactions leads to higher aggregate asset prices for which a higher amount of money balances is needed to carry out these transactions. Furthermore, higher asset prices revalue the stock of wealth of the individuals which can positively affect the demand for money. It is also possible that the increase in asset prices has the

direct consequence of increasing the borrowing of some of the sectors of the economy from the financial institutions and the lending is also increased due to the improved net worth of the borrowers because of the increase in asset prices. This expansion of credit which is considered as the asset side of bank's balance sheet may drive the money stock which is the liabilities side. If the competitive pressure in the financial system intensifies, the magnitude of these effects is expected to be larger and the asset prices can be used as a proxy for them. Therefore, it can be said that any observed correlation between asset prices and money stock may represent supply side effects. The study by Borio, Kennedy & Prowse, (1994) shows that a statistically significant relationship between money and asset prices survives in as many as six of the eleven countries identified in the bivariate regressions. Moreover, the inclusion of real asset price makes a difference in the sense that once asset prices are included in the money demand function, the unit elasticities with respect to both income and prices are accepted in all cases.

A few studies have been conducted on the effect of separate asset prices such as stock prices and exchange rate on the demand for money. Friedman (1988) suggests two types of effects of the changes in the stock prices on the demand for money and velocity of money; positive wealth effect and negative substitution effect. The positive wealth effect operates due to three reasons; first, an increase in stock prices leads to an increase in the nominal wealth which implies an increase in wealth to income ratio that reflects in higher money to income ratio or a declining velocity. Second, increasing stock prices reflect an increase in the expected returns of the risky assets relative to safe assets. The resulting increase in relative risk induces people to increase the safe assets in their portfolio such as money and decrease the risky assets. Third, an increase in asset prices may lead to increase the volume of financial transactions, thereby leading to an increase in the demand for money to facilitate these transactions. The negative substitution effect of increased stock prices on money demand implies that an increase in stock prices makes equities more attractive as compared to other assets in the portfolio. Consequently, there may be a shift from holding money to stocks. Therefore, the net effect of stock prices on demand for money may be positive or negative.

The effect of exchange rate on demand for money depends on two competing forces. The depreciation of local currency increases the net

value of foreign securities for domestic residents. This can be considered as an increase in wealth thereby leading to increase in the demand for money. However, if depreciation leads to the expectations of future depreciation in currency then the demand for domestic currency in portfolio decreases and that of foreign currency increases. This cycle continues as the currency substitution takes place and people lose confidence in domestic currency (Arango & Nadiri, 1981; Bahmani-Oskoee & Techaranachai, 1991 & 2001).

LITERATURE WITH REGARDS TO PAKISTAN

There is an abundance of literature in Pakistan that has worked on the estimation of money demand function for Pakistan and also about the potential determinants and the stability of the money demand function. Rehman and Afzal (2003) empirically analyze the impact of black market exchange rate on the demand for money in Pakistan where due to exchange rate controls black market and official rates operate side by side. Their study concludes that the desired holding of the real money balances has positive effect on real income and black market exchange rate whereas inflation is negatively affected by them. The study also suggests that for effective policy formulation M2 monetary aggregate is the right aggregate to consider. Qayyum (2005) analyze dynamic money demand function for Pakistan and comes to conclude that inflation and income are important short run determinants of money demand where inflation negatively affects money demand while income affects positively and the rate of interest, market rate, and bond yield are significant for the long run behaviour of the money demand function. Khan and Sajid (2005) analyze the long run as well as short run relationships between real money balances, real income, inflation rate, foreign interest rate and real effective exchange rate using ARDL technique. The paper concludes that real money balances are significantly affected by the long run real income, inflation rate, foreign interest rate and the real effective exchange rate in Pakistan. Moreover, the demand for real money balances is found stable in Pakistan. Similarly, Hye et al., (2009) estimated the relationship between money demand, interest rate, economic activity, inflation rate, stock prices and exchange rate and find that stock prices have significant and positive wealth effect whereas exchange rate has insignificant effects on money demand. Also, the

inflation rate has a significant and negative effect on demand for money. Faridi & Akhtar (2013) attempt to estimate factors that determine the real money demand function in Pakistan and conclude that real GDP, financial innovation and total population have positive effects on real money demand whereas deposit rate and exchange rate are negatively related to real money demand in Pakistan.

The studies specifically focusing on the stability of money demand function in Pakistan include Moinuddin (2009), Sarwar, Hussain, & Sarwar (2010) and Omer (2010). Moinuddin (2009) put forward that money demand function is unstable in Pakistan, therefore, monetary aggregates targeting should not be used by the State Bank of Pakistan. However, this study does not provide any satisfactory explanation for the large negative intercept for the estimated broad money demand model; therefore, it is suspected to suffer from specification bias. Sarwar et al. (2010) highlights that M2 is the right monetary aggregate that provides proper stable money demand function in Pakistan. Their study also finds that the real GDP is positively while the interest rate – the opportunity cost of money – are negatively related to the demand for real balances. The study also suggests considering financial innovation for monetary policy formulation because the demand for monetary assets is also affected by the financial developments. Omer (2010) proves that the velocities of all the three monetary aggregates M0, M1, M2 have stable relationship with their determinants and the velocities of base money and broad money are independent of the fluctuation in the interest rates. The study, therefore, suggests using the monetary aggregates as nominal anchor.

III. ECONOMETRIC METHODOLOGY

ASSET PRICES AND THE DEMAND FOR MONEY: MULTIVARIATE REGRESSION ANALYSIS

We specify a money demand function that relates the demand for money balances to price level, real income, short run and long run interest rates and the real asset prices.

$$\log M_t = \alpha + \beta \log\left(\frac{AP}{P}\right)_t + \sum \gamma_j \log(X_{jt}) + \sum \delta_j \log M_{t-j} + \varepsilon_t \qquad (1)$$

Where M_t is the broad monetary aggregate, AP/P is the real asset price index, X is a vector of j variables including log P (log GDP deflator), log Y/P (log real GDP), RS (short term interest rate), RL (Long term interest rate), log AP/P (log real asset price index). All the above mentioned variables are related to money demand function by some theoretical background, therefore, it is appropriate to perform the multivariate analysis.

We run this regression for four types of real asset price indices and also run the regression using separate asset prices such as house price index, share prices and exchange rate as the independent variable. The estimation is carried out after testing stationarity properties of variables, incorporating structural breaks in the model, removing autocorrelation of errors, and the computation of long run coefficients.

Few important steps have been followed in the estimation of all the regressions in our study. First, the presence of non-stationary variables may lead to spurious estimates, therefore, we have checked the stationarity of the residuals: this two-step method of first estimating regression of non-stationary variables and then in the second step testing stationarity of residual series is the famous Engle-Granger cointergration test which shows that whether or not there exists a long run equilibrium relationship between asset price index and the demand for money. Second, in order to handle the structural breaks and consequent instability of parameters in our times series data, we have incorporated dummy variables for financial sector reforms, switch to floating exchange rate regime, 9/11 incident and the global financial crisis. Third, we have included lags of the dependent variables in order to deal with the autocorrelated errors in our model. Lags have been selected on the basis of the minimum Akaike Information Criterion (AIC) of the regression model and considering the quarterly frequency of data, maximum 12 lags have been used. Finally, we have made adjustments to compute long run coefficients of the model as the model contains lagged dependent variable.

ASSET PRICES AND THE DEMAND FOR MONEY: VECM

Due to some undesirable properties of Engle-Granger test in multivariate regression we also estimated money demand function including asset prices as Vector Error Correction Model (VECM) and

tested cointegration using Johansen test. VECM allows for dynamic effects through the popular error correction formulation, including lagged values of the variables and at least their contemporaneous first differences. Lags are selected on the basis of Akaike information criterion. However, the lags are increased if the errors have autocorrelation. The Johansen Likelihood ratio test based on trace statistics and maximum Eigen values is applied to test for the cointegration. The VECM formulation is written as:

$$\Delta \log M_t = \alpha + \sum \beta_{ji} \Delta \log \left(\frac{AP}{P} \right)_{jt-i} + \sum \delta_{ji} \Delta X_{jt-i} + \sum \chi_j Y_{jt-1} + \sum \lambda_i \log \Delta M_{t-i} + \varepsilon_t \qquad (2)$$

Where i= 1,2, 3, p represents lag length, while j denotes variables. Mt is the broad monetary aggregate, Y is a vector of dependent and independent variables as Y = [X, M], Xi is a vector of control variables that includes log P (GDP deflator), log Y/P (real GDP), RS (short term interest rate), RL (Long term interest rate), log AP/P (real asset price index). Xit-1 is the lag of all the variables included in Xit, Mt-i represents the lags of the dependent variable. εt is the vector of error terms.

This multivariate analysis is performed for the four types of asset price indices (explained below) constructed and also for the separate assets as well. To check the significance of the short run coefficients we also perform the Wald coefficient test on the lagged coefficients.

CONSTRUCTION OF VARIABLES

Nominal GDP and Real GDP

The data on nominal and real GDP are taken from Hanif et al (2013) and Arby (2008) for time period 1982-2010. For the computation of data for the time period 2011-17, we calculated quarterly shares of annual GDP from previous data and observed their variations. Based on the small variations in shares, we assumed that the shares that we are taking for the data of the next 6 years are stable. Therefore, we took the twelve quarters moving average of the shares of the last ten years with the assumption that this average is stable for the next 6 years. By multiplying these quarterly shares with the annual GDP of 2011-17 we get quarterly estimates of GDP.

House Price Index:

Data on House Price Index (HPI) are not available. Therefore, we have constructed HPI using data on House Rent Index (HRI); for this purpose, we have used two methods. In the first method, we have used data on HPI and HPI from January 2011 to April 2017 and established the relationship between these two variables by using unrestricted VAR. We have taken HRI and HPI in the form of difference of log values. The values of HPI for 1982 to 2010 are back-casted using VAR results. For the second method, we have used data on HRI and HPI from January 2011 to April 2017 and identify the structural breaks in both series. We have then de-trended both series using breaking trend method and estimated relationship between these de-trended series. On the basis of this relationship we have back-casted data on HPI using data on HRI. Finally, we have evaluated forecast efficiency of both methods on the basis of Diebold - Mariano test and found VAR based forecasts more efficient. We, therefore, use values of HPI back-casted through VAR model.

Asset Price Index (API):

In order to construct an Asset price index (API) using HPI, stock prices and exchange rate, we use four methods of assigning weights to the three assets in the construction of API. First, API is constructed by assigning weights according to the market share of each asset. Second, API is constructed by assigning weights according to the inverse variance criterion. In this method, first, we find the rate of change of each asset price series, i.e. share prices, house prices, and exchange rate. Then the variance of the rate of change of each asset is calculated and the final weights for each asset type are calculated according to inverse variance formula. Third, API is constructed by assigning weights according to factor analysis computed by quarterly factor scores using factor analysis for share prices, exchange rate and house price index. Fourth, equal weights are assigned to all the three asset prices.

DATA SOURCES

We have used quarterly data of variables over the period 1981 Q1 to 2017 Q2. The data on exchange rate and share prices are taken from international financial statistics. The data on broad money, long term rate

of interest *i.e*. 5 years and above deposit rates, short term rate of interest i.e. 6 months and below deposit rates, house rent index and market capitalization are taken from the annual reports of State Bank of Pakistan. Finally, the data on housing services and foreign exchange reserves are taken from the economic surveys of Pakistan.

IV. RESULTS

RESULTS OF UNIT ROOT TEST

Before going to formal analysis of multivariate regression and VECM first we test the order of integration of each variable included in the regression. For this purpose, we have used two-unit root tests namely, Augmented Dickey-Fuller test and Phillips-Perron test. Variables other than interest rate are taken in logarithmic form and trend and intercept are included in each specification at level while only intercept is included when testing unit root at first difference. Lag length in the test equation is selected by Schwarz criterion. It has been found that all variables included in the analysis are integrated of order one as null hypothesis of unit root cannot be rejected for all variables at level but opposite is true in case of first difference (Table 1). In this scenario regression results are reliable only if co-integration exists among variables.

TABLE 1

Unit Root Test Results

Variable	Augmented Dickey-Fuller Stat		Phillips-Perron Stat	
	Level	First Difference	Level	First Difference
Log(M2)	-1.82 (0.69)	-10.14 (0.00)	-2.02 (0.59)	-10.31 (0.00)
Log(GDPD)	-2.12 0.53	-18.02 (0.00)	-2.41 (0.37)	-17.27 (0.00)
Log(RGDP)	-2.29 0.44	-6.59 (0.00)	-1.04 (0.74)	-33.26 (0.00)
Log(API)	-2.46 0.35	-3.18 (0.02)	-1.87 (0.34)	-3.59 (0.01)
RS	-2.33 0.41	-3.75 (0.00)	-2.35 (0.40)	-7.99 (0.00)
RL	-1.83 0.68	-3.73 (0.00)	-0.96 (0.77)	-7.97 (0.00)

Note: probability values of accepting the null hypothesis of unit root are given in parentheses.

ASSET PRICES AND THE DEMAND FOR MONEY: MULTIVARIATE REGRESSION ANALYSIS

The results of multiple regression of demand for money are summarized in the table 2. We have used 5 lags for model 1, 2, and 4 and 7 lags for model 3. The explanatory power of all the specifications is very high. The hypothesis of no autocorrelation is accepted at 1st and 4th lag for all specifications. The Engel Granger tau stat shows that, except for model 3, all the models have stationary residuals. The coefficient of the GDP deflator is positive as expected according to theory, in all specifications. Moreover, it is statistically significant in all specifications and its magnitude ranges 0.11 to 0.13. This means that the demand for nominal money increases with the increase in price level in Pakistan.

As we are using lags of the dependent variable in the regression so the coefficient should be adjusted for long run. The long run coefficient of price level ranges 0.7 to 1.2 in all specifications which is near one as is expected from the theory and also conform with Borio et al. (1994), Azim et al. (2010) and Faridi & Akhtar (2013). Real GDP also has less than unity, positive sign and is statistically significant as well. The long run coefficient of real GDP ranges 1.12 to 1.44 which means that income elasticity of money demand is high in the long run. Our findings are consistent with Omer (2010), Yu. Hsing (2007), Azim et al. (2010) and Faridi and Akhtar (2013). The empirical literature suggests that the coefficient of Real GDP is less than that of GDP deflator but in our all specifications the coefficient of Real GDP is greater than that of GDP deflator which corroborates with the studies by Borio, Kennedy & Prowse. (1994), Azim et al. (2010), and Moinuddin (2009). The possible explanation for finding a higher coefficient of real GDP can be given as: first, an increase in income leads to an increase in transactions demand for money but this depends on the marginal propensity to consume (MPC). If MPC is low then lower would be the effect on money demand due to increase in income. If MPC is high then increase in income would have more effect on the money demand. As the saving rate is low in Pakistan which means that APC and hence MPC is high. Therefore, an increase in income would have more effect on the demand for money. Second, if the increase in income increases the borrowing capacity of the

people then the demand for money can increase more than the increase in income.

TABLE 2

Money Demand Function: Regression Analysis

		M2	M2	M2	M2
Short run Coefficients	Constant	-0.745 (0.000)	-0.785 (0.000)	-0.876 (0.003)	-0.870 (0.000)
	GDP Deflator	0.121 (0.000)	0.134 (0.000)	0.124 (0.013)	0.114 (0.000)
	Real GDP	0.188 (0.000)	0.215 (0.000)	0.146 (0.000)	0.187 (0.000)
	RS	-0.008 (0.001)	-0.010 (0.000)	-0.003 (0.083)	-0.004 (0.056)
	RL	0.003 (0.044)	0.004 (0.013)	0.001 (0.214)	0.001 (0.281)
	Asset Prices	0.018 (0.001)	0.048 (0.000)	0.067 (0.203)	0.048 (0.021)
Longrun Coefficients	GDP Deflator	0.724	0.697	1.222	0.739
	Real GDP	1.123	1.120	1.441	1.258
	RS	-0.048	-0.050	-0.033	-0.029
	RL	0.020	0.021	0.015	0.011
	Asset Prices	0.110	0.248	0.661	0.294
	Adj R-square	0.999	0.999	0.999	0.999
	Q-Stat (1)	0.093 (0.760)	0.202 (0.653)	0.063 (0.802)	0.005 (0.947)
	Q-Stat (4)	2.183 (0.702)	3.345 (0.502)	2.452 (0.653)	2.266 (0.687)
	EG Tau stat	-6.010 (0.002)	-6.720 (0.000)	-3.771 (0.359)	-5.150 (0.022)

Note: Probability values for accepting null hypothesis are given in parentheses. Appropriate lag length is selected on the basis of minimum AIC. All variables are seasonally adjusted and are in logarithmic form except interest rate.

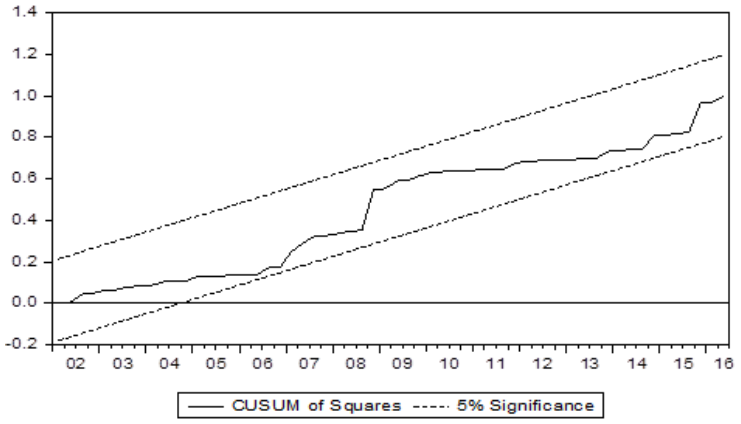
The short run interest rate is showing a significant negative relationship with the demand for money. The coefficient of long term interest rate is positive, which contradicts standard theory but it is statistically significant only in two specifications. This positive sign can be justified as increase in long run interest rate may discourage investors

in goods market and divert resources towards asset market. Investors need money to switch from goods market and purchase assets. This switching takes place because asset market is at better competitive position for credit allocation at higher cost of credit in Pakistan where entrepreneurship cannot compete with rent-seeking as far as allocation of funds is considered. The coefficient of asset prices in all four specifications is having a positive sign and is statistically significant in three out of four specifications. It lies in the range 0.02 to 0.08. Moreover, the long run coefficient of asset prices is in the range 0.1 to 0.7 which signifies a long run relationship where an increase in the asset prices leads to an increase in the demand for money. Hence it can be said that asset prices are an important element in explaining money demand function in Pakistan.

Parameters of the money demand function are found stable as is shown by CUSUM of square test in figure 1. We have shown stability test results only for third specification but in Table 2. However, coefficients are found stable in all of the specifications.

Figure 1

Conceptual Framework



The results of money demand function with separate asset prices are given in Table 3 below. The coefficients of GDP deflator, real GDP, and short run rate of interest have the correct signs and are also statistically significant. The coefficients of house prices and share prices are positive and statistically significant at 1% and 5% level of significance,

respectively. This signifies that positive wealth effect operates in case of Pakistan where an increase in share prices increases the demand for money which is consistent with Friedman (1988), Hsing (2007) where the direction of effect depends on the wealth or substitution effect of the share prices. Hye et al (2009) also found out that the stock prices have a positive wealth effect on the demand for money. This implies that an increase in the housing and share prices, via positive wealth effect, leads to an increase in the demand for money balances in Pakistan. However, the coefficient of exchange rate is negative and statistically insignificant which indicates that exchange rate is not helpful in explaining the demand for money in Pakistan. If expectations are adaptive then actual depreciation of currency predicts future depreciation so the effect of actual and anticipated depreciation is same. In actual depreciation, the net exports of the economy increase due to increase in exports and decrease in imports.

TABLE 3

Money Demand Function with Different Types of Asset Prices: Regression Analysis

	SR coefficient	Prob Value	LR Coefficient
Constant	-0.672	(0.004)	
GDP Deflator	0.115	(0.004)	0.701
Real GDP	0.173	(0.001)	1.058
RS	-0.006	(0.002)	-0.039
RL	0.004	(0.034)	0.022
House Prices	0.018	(0.001)	0.111
Exchange Rate	-0.011	(0.687)	-0.069
Share Prices	0.014	(0.039)	0.086
Adj R-square	0.999		-----
Q-Stat (1)	0.260	(0.610)	-----
Q-Stat (4)	2.784	(0.595)	-----
EG Tau stat	-6.052	(0.009)	-----

Note: Probability values for accepting null hypothesis are given in parentheses. Appropriate lag length is selected on the basis of minimum AIC. All variables are seasonally adjusted and are in logarithmic form except interest rate. Parameters are found stable as measured by CUSUM of square test. Results of stability test are not reported here but can be requested from the authors.

The increase in exports signifies either an increase in the foreign exchange reserves of the country or an increase in the demand for domestic currency. The decrease in imports implies that the demand for foreign currency has decreased which means that demand for domestic currency has increased in relative terms as well. Hence, the effect of actual depreciation on money demand is always positive. Moreover, if the depreciation is anticipated then its effect on money demand will be negative. Actual depreciation is related to traders who are involved in international trade and anticipated depreciation is related to speculators. In all this process one group is increasing the demand for money and the other is decreasing it, therefore, the net effect would depend on whichever effect is stronger or if both the effects are equal then net effect on money demand would be zero. It can be concluded that the wealth effect of currency depreciation equals the substitution effect in case of Pakistan. This result is consistent with various other studies such as Hye et al. (2009), Azim et al, (2010), Faridi & Akhtar (2013) etc.

ASSET PRICES AND THE DEMAND FOR MONEY: VECM

In order to see the dynamic effects, we use vector error correction formulation for the asset price indices. The results are summarized in Table 4. The long run coefficient of GDP deflator is positive and statistically significant and has almost the same range as in regression analysis i.e. 0.68 to 1.02. The sum of short run coefficients of GDP deflator is positive in two specifications but statistically significant in only 4th specification and it is negative in two remaining specifications but statistically insignificant in both of them. This insignificance does not mean that it has no effect in short run because it is the sum of short run coefficients which means that the sum of short run coefficients is not statistically different from zero. One specification shows a positive net effect which is statistically significant as well.

Real GDP is positive and statistically significant. However, the coefficient of real GDP is negative in one specification but it is statistically insignificant. The coefficients of short run interest rate are negative and statistically significant in three specifications and insignificant in fourth specification.

TABLE 4

Results of Money Demand Function: VECM

		M2	M2	M2	M2
Long run Coefficients	Constant	-6.395 [16.369]	-4.495 [-12.697]	3.260 [0.743]	-5.107 [-2.248]
	GDP Deflator	0.684 [18.542]	0.789 [21.124]	1.025 [1.677]	1.061 [5.332]
	Real GDP	1.457 [22.142]	1.207 [18.439]	-0.293 [-0.539]	0.423 [1.066]
	RS	-0.036 [-10.498]	-0.049 [-15.129]	-0.052 [6.408]	0.012 [0.489]
	RL	-0.012 [-5.071]	-0.010 [-3.924]	-0.001 [-0.122]	0.032 [1.973]
	Asset Prices	0.157 [16.369]	0.262 [8.139]	0.261 [0.455]	1.628 [5.688]
Short run Coefficients (sum)	ECM	-0.176 [-1.057]	-0.015 [-0.104]	-0.151 [-1.956]	-0.008 [-0.524]
	GDP Deflator	-0.239 [-0.405]	0.156 [0.298]	-2.987 [-1.406]	0.546 [2.482]
	Real GDP	0.412 [0.203]	2.436 [1.321]	1.744 [2.041]	0.746 [1.742]
	RS	-0.019 [-0.743]	-0.016 [-0.591]	-0.013 [-0.523]	-0.022 [-1.867]
	RL	0.048 [1.087]	0.015 [0.353]	0.057 [1.936]	0.009 [0.882]
	Asset Prices	-0.219 [-1.409]	-0.349 [-1.610]	-2.705 [-1.491]	0.216 [1.670]
	Adj R-square	0.333	0.310	0.384	0.145
	LM-Stat (1)	38.496 (0.357)	52.906 (0.034)	43.348 (0.187)	47.333 (0.098)
	LM-Stat (4)	31.119 (0.699)	43.651 (0.178)	43.249 (0.189)	33.363 (0.595)
	Trace stat	303.2520 (0.000)	272.604 (0.000)	227.873 (0.000)	165.913 (0.000)
	Max-Eigen stat	109.881 (0.000)	117.493 (0.000)	88.970 (0.000)	56.600 (0.000)

Note: t-stats and probability values for accepting null hypothesis are given in parentheses. Appropriate lag length is selected on the basis of LR, FPE, AIC, SC, HQ criterion. All variables are seasonally adjusted and are in logarithmic form except interest rate.

The coefficients of long run interest rate are negative in three specifications and statistically significant in two of them but positive and insignificant in fourth model. The coefficient on asset price term is positive in all cases and statistically significant in three of them and it ranges from 0.16 to 0.26. This signifies the existence of a long run relationship. The sum of short run coefficients of asset price term is

negative in three specifications and positive in fourth one but it is statistically insignificant in all specifications which implies that the sum of short run coefficients is not statistically different from zero, hence the net effect is zero.

The error correction term is negative but insignificant for the M2 in all specifications which means that M2 does not respond to disequilibrium in the short run. However, it is short term rate of interest in first specification, Real GDP, short run and long run interest rate for specification 2 and 4, real GDP and long run interest rate for 3, which corrects the short run disturbance each quarter in the system.

We have selected 12 lags for the VECM in first three specifications and 5 lags for fourth specification. LM stats indicates no autocorrelation of errors at 1st and 4th lag. The value of adjusted R square is low in all specifications because in short run regressions the dependent variable is in differenced form, therefore, the R square with differenced variable is low. The trace stats and Max Eigen stats indicate the presence of cointegration at 5% level of significance and justify the use of vector error correction model.

We perform the VECM analysis for different types of asset prices in money demand function and get the similar results which are reported in Table 5. We have used 13 lags in this model. The long run coefficients of GDP deflator and real GDP are positive and significant. The coefficients of short term and long term interest rate are negative and statistically significant. The coefficients of house prices and share prices are positive and statistically significant but for exchange rate it is negative. It was discussed in the regression analysis of demand for money that, when the effect of actual and anticipated depreciation balance out, the net effect on money demand is zero. Here we can say that the effect of anticipated depreciation dominates, thereby leading to a fall in money demand due to increase in exchange rate.

TABLE 5

Result of Money Demand Function with Different Types of Asset Prices: VECM

	LR coefficient	t-stat	SR Coefficient	t-stat
Constant	-9.012	-24.695		
GDP Deflator	0.272	4.459	1.369	0.942
Real GDP	2.169	23.704	2.979	0.648
RS	-0.009	-3.406	-0.043	-0.344
RL	-0.020	-12.517	-0.097	0.617
House Prices	0.158	12.045	0.193	0.675
Exchange Rate	-0.411	-5.726	-0.156	-0.156
Share Prices	0.124	10.461	0.425	1.470
Adj R-square	0.374	-----	-----	-----
LM-Stat (1)	73.512	0.195	-----	-----
LM-Stat (4)	108.705	0.000	-----	-----
Trace stats	1603.182	0.000	-----	-----
Max-Eigen stats	448.591	0.000	-----	-----

Note: t-stats and probability values for accepting null hypothesis are given in parentheses. Appropriate lag length is selected on the basis of LR, FPE, AIC, SC, HQ criterion. All variables are seasonally adjusted and are in logarithmic form except interest rate

V. CONCLUSION

A stable and predictable money demand function is considered a precondition for the monetary aggregates targeting as a tool of monetary policy. Moreover, a stable money demand function justifies the use of monetary aggregates targeting as an intermediate target, otherwise it is replaced with the interest rate targeting. In Pakistan many studies have estimated the money demand function by employing different cointegration techniques. Moreover, a few studies have also studied the stability of money demand function in Pakistan. However, no study, to the best of our knowledge, has ever incorporated the important variable

of asset prices to determine the stability of the money demand function in Pakistan.

Therefore, the objective of the study was to participate in the debate on the instability of money demand function with the inclusion of asset prices in the model for Pakistan. In this study, we have used asset price indices for the explanation of the money demand function in Pakistan for the time period 1981-Q1 to 2017-Q2. The evidence of the analysis suggests that asset prices play a statistically significant and stable role in explaining the money demand function. The coefficient of the asset price index has positive sign and its long run coefficient ranges from 0.11 to 1.62. This implies a positive relationship between asset prices and the demand for money whereby, an increase in the asset prices leads to an increase in the amount of money demanded. Our findings are consistent with the Borio, Kennedy, & Prowse (1994) and conform to our hypothesis and suggest that asset prices serve as a crucial variable in explaining the money demand function in Pakistan.

Results of this paper have important policy implications. Considering the evidence of the analysis presented in this study, it can be concluded that the addition of aggregate asset price index in the money demand function may indeed be useful for the stability properties of the money demand function and for the further research in this area. Therefore, State Bank of Pakistan should not ignore monetary aggregaes as an indicator of monetary policy on the basis of instability of money demand function. The instability of the function arises from the absence of asset price index which is an important indicator of monetary policy decisions; therefore, it should be given due weight in monetary policy decisions.

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