Journal of Economic Cooperation and Development, **43**, 3 (2022), 71-96

Do Economic Uncertainty and Monetary Uncertainty Matter for Money Demand? Evidence from Pakistan

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ABSTRACT

Although the theoretical debate on money demand is not new, yet the empirical literature is inconclusive regarding the role and contribution of macroeconomic factors in determining money demand function and its stability. This study explores, empirically, the role of economic and monetary uncertainties in determining money demand function for Pakistan over the time period from 1975 to 2018. Upon checking the prerequisite of the technique, the empirical assessment is carried out by using the autoregressive distributed lag (ARDL) model. The findings specify that money demand function is responsive to major macroeconomic variables including both the uncertainty measures. In particular, economic uncertainty tends to diminish while monetary uncertainty appears to increase money demand in the long run. It can be observed from the results that economic agents in Pakistan are more sensitive to economic uncertainty as compared to monetary uncertainty with regard to their decision for cash balances.

ملخص

على الرغم من أن النقاش النظري بشأن الطلب على الأموال ليس بالأمر الجديد، فإن المؤلفات التجريبية غير حاسمة فيما يتعلق بدور ومساهمة عوامل الاقتصاد الكلي في تحديد وظيفة الطلب على الأموال واستقرارها. وتستكشف هذه الدراسة، من الناحية التجريبية، دور الشكوك الاقتصادية والنقدية في تحديد وظيفة الطلب على الأموال في باكستان خلال الفترة الزمنية الممتدة ما بين 1975 و 2018. وعند التحقق من الشرط الأساسي لهذه التقنية، يتم إجراء التقييم التجريبي باستخدام نموذج الانحدار الذاتي للإبطاء الموزع (ARDL). وتشير النتائج إلى أن وظيفة الطلب على الأموال تستجيب

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لمتغيرات الاقتصاد الكلي الرئيسية بما في ذلك التدابير المتعلقة بحالات عدم اليقين. وعلى وجه الخصوص، يميل عدم اليقين الاقتصادي إلى التضاؤل بينما يبدو أن عدم اليقين النقدي يزيد الطلب على الأموال على المدى الطويل. ومن خلال النتائج، يمكن استنتاج أن الوكلاء الاقتصاديين في باكستان أكثر حساسية لحالات عدم اليقين الاقتصادي بالمقارنة مع عدم اليقين النقدي فيما يتعلق بقراراتهم بشأن الأرصدة النقدية.

ABSTRAITE

Bien que le débat théorique sur la demande de monnaie ne soit pas nouveau, la littérature empirique n'est pas concluante quant au rôle et à la contribution des facteurs macroéconomiques dans la détermination de la fonction de demande de monnaie et de sa stabilité. Cette étude explore, de manière empirique, le rôle des incertitudes économiques et monétaires dans la détermination de la fonction de demande de monnaie pour le Pakistan sur la période allant de 1975 à 2018. Après avoir vérifié les conditions préalables de la technique, l'évaluation empirique est effectuée en utilisant le modèle ARDL Modèle Auto régressif à Retards Échelonnés). Les résultats précisent que la fonction de demande de monnaie est sensible aux principales variables macroéconomiques, y compris les deux mesures d'incertitudes. En particulier, l'incertitude économique tend à diminuer alors que l'incertitude monétaire semble augmenter la demande de monnaie à long terme. On peut observer à partir des résultats que les agents économiques au Pakistan sont plus sensibles à l'incertitude économique qu'à l'incertitude monétaire en ce qui concerne leur décision pour les soldes de trésorerie.

Keywords: Money Demand, Economic Uncertainty, Monetary Uncertainty, Exchange Rate

JEL Classification: D81, E41, E52, P44

1. Introduction

Stable money market is an important element not only for prudent monetary policy formation but also for effective functioning of the transmission mechanism of monetary policy. Given the fixed supply side conditions of money market, the dominant role is played by money demand (MD) in determining the stability of money market. Moreover, money demand plays a central role in monetary policy formation as it provides guidance in devising optimal monetary policy. Through the combination of liquid and semi-liquid assets as medium of exchange,

money demand function (MDF) provides a set of tools to monetary authorities to attain macroeconomic goals.

The theoretical debate on MD focused on its two important determinants, namely, nominal income and interest rate. Fisher (1911) through quantity theory of money, and Pigou (1917) and Marshall (1923) in Cambridge approach focused on nominal income as the key factor to determine MD. The former focused on the supply side while the latter introduced the demand side of money market to explain the relationship between MD and national income. Furthermore, by stressing interest rate rather than constant velocity of MD, Keynes (1936) in the Liquidity Preference theory postulated that money functions both as a medium of exchange and as a store of considerable value. The most noteworthy breakthrough in Keynes's study of demand for money, however, is the speculative demand for money which clearly indicates a negative association between interest rate and MD. Similarly, Friedman (1956) and Tobin (1958) introduced portfolio theories of money demand which initiated the debate on the stability/instability of money demand function. These theories provided the idea of alternate assets to which economic agents can switch in case of any uncertainty in an economy.

On the empirical grounds, MDF gained considerable attention during 1970s, when the United States (US) economy faced great instability in money demand. Since then, the literature has introduced a wide range of factors which play significant role in explaining MDF and its stability. The initial work is mainly confined to the estimation of MDF by taking income and interest rate as main determinants (Goldfeld, 1976; Gordon, 1984; Goldfeld and Sichel, 1990; Baba, Hendry, and Starr, 1992; Pakko, 1995; Dekle and Pradhan,1997; Peria, 2002; Civcir, 2003; Çatık, 2007).These studies not only concluded that income and interest rate are significant determinants of money demand but also highlighted the importance of incorporating the element of uncertainty in estimating MDF. This led to the emergence of another strand of literature emphasizing the role of monetary and real uncertainty in estimation of MDF. Friedman (1984) provided the pioneering work by empirically identifying volatility of money supply as a major contributor to the level of MD. He explained a positive association between money growth volatility and cash holdings; as increase in the money growth volatility instigates uncertainty in the economy and consequently increases MD. Additionally, Choi and Oh (2003) contributed, on theoretical grounds, by

introducing output volatility in the demand for money function. They delineated that output volatility induces the future uncertainty in labor market, thereby accelerating the cash holdings. Later, the empirical studies examined the money demand function by incorporating various types of uncertainties (see, for instance, Bruggeman et al., 2003; Atta-Mensah, 2004; Greiber and Lemke, 2005; Cronin and Kennedy, 2007; Bahmani-Oskooee and Xi, 2011; Bahmani-Oskooee et al.,2012; Bahmani-Oskooee et al., 2013); Bahmani-Oskooee et al., 2015; Gan et al., 2015; Islam, 2015; Bahmani-Oskooee and Baek, 2017; and El-Rasheed, Abdullah, and Dahalan, 2017) These studies stressed the significance of adding an indicator of uncertainty in determining MDF.

Pakistan, being a developing country has undergone various transitions particularly when it comes to money market development (Choudri et al., 2015). Like many other countries, the stability of MD has always been a key concern in Pakistan. Particularly, inflationary pressure during 1970s amid the oil price shocks, consequent minor recession and movement towards economic, financial and capital account liberalization during early 1990s led to the reformation of MDF and redesigning of monetary policy in Pakistan. Notably, four sets of reforms were introduced in the money market; a) strengthening of institutional setup, expansion in supervisory prerogative and autonomy of the State Bank of Pakistan (SBP), issuance of prudential regulations for banks, credit rationing of nonbank financial institutions (NBFIs) and banks, and Basel accord; b) Debt management reforms including setting up of securities department at the SBP, auction system of treasury bills, national saving scheme and its rationalization, and bearer instrument; c) monetary management measures such as statutory and averaging cash reserve requirement, discount window replacement with a three day repo facility, introduction of open market operation, removal of caps on maximum and minimum liquidity rates, and rationalization of subsidized credit; d) exchange and payment reforms such as permission to open foreign currency account, remittance of profit, market based exchange rate system, creation of Pakistan credit rating agency, creation of control depository company, and formation of securities and exchange commission of Pakistan. These reforms have directly and/or indirectly influenced money market functioning and efficiency in Pakistan (Zaidi, 2015).

With the above stated background, the prime objective of the present study is to examine whether economic and monetary uncertainties affect

MD in Pakistan and whether MDF exhibits stability during the sample period of the study. Considering that Pakistan has been on the path of trade liberalization and deregulation since 1980s, this study has estimated a MDF in the presence of both types of uncertainties particularly in an open economy framework. The key contribution of the study is apparent from the fact that it has attempted to incorporate two uncertainty measures in its empirical exercise which has not been done by the earlier literature concerning MDF for Pakistan. To this end, MDF inclusive of economic uncertainty and monetary uncertainty has been estimated by means of the autoregressive distributed lag (ARDL) model. In doing so, the main interest is to identify which type of uncertainty is relatively more vital not only for MDF but also for appropriate monetary policy design. Our findings will be conducive in identifying the relative importance of both the uncertainties in restructuring the MDF in Pakistan.

The remainder of the paper is structured as follows: review of literature is contained in section 2; the model, data and econometric methodology are given in section 3; results and discussion are provided in section 4; and final section comprises of conclusions and policy recommendations.

2. Literature Review

The theoretical and empirical literature on MD is diverse and multifaceted. Theoretically, the debate on money demand is originated from quantity theory of money established by Fisher (1911) and the Cambridge approach to MD proposed by Marshal (1923) and Pigou (1917). While both theories recognized income as an important determinant of MD, the former explained the supply side while latter stressed the importance of demand side in defining the MDF. A notable development in the MD theory is witnessed in the liquidity preference concept proposed by Keynes (1936). The liquidity preference theory highlighted the importance of interest rate as a significant determinant of MD along with income. Interest rate functions as an opportunity cost of cash holdings, therefore, any variation in interest rate influences the preferences of individuals to hold money. This led to a new era of debate on MDF and money market stability i.e. the role of uncertainty in determining the money market stability. Carrying the same spirit of Keynes liquidity preference theory, Friedman (1956) and Tobin (1958) introduced the portfolio theories of MD which initiated the debate of stable and unstable MDF.

The empirical work, on the other hand, concerning MDF and its stability can be split into two strands. The first strand's empirical underpinnings gained considerable momentum during 1970s when the US economy experienced great instability in its MD. The notable contribution in this regard were made by Goldfeld (1976), Gordon (1984), Goldfeld and Sichel (1990), and Baba, Hendry, and Starr (1992). The literature argued that MD is imperative for devising stable monetary policy. Moreover, it was also documented that MDF plays a significant role in determining the association between monetary aggregates and national income. Similar evidence was provided for the emerging markets by Dekle and Pradhan (1997), Peria (2002),Civcir (2003),and Çatık (2007), among others. Furthermore, McNown and Wallace (1992) introduced nominal exchange rate as a significant determinant of MD.

The second strand of literature focused on the role of uncertainty in the formation of MDF. To this end, Friedman (1984) provided the baseline work while analyzing the responsiveness of MD to monetary uncertainty. He reported an increase in MD in consequent to fluctuations in money supply. As higher money growth leads to decline in velocity of money, thence an increase in MD by economic agents. He further elucidated that an increase in the volatility of money growth escalates the degree of anticipated uncertainty which consequently increases MD. Hall and Noble (1987) conducted one of the earliest tests of Freidman's hypothesis and concluded that monetary growth uncertainty increases velocity of money. By following this framework, voluminous studies have been come to the surface on redefining MDF by including various forms of uncertainties in the traditional MDF. The studies stated that uncertainty in the money market creates unpredictable environment and inability to forecast the behavior of economic agents regarding MD. For instance, Atta-Mensah (2004) and Qureshi et al., (2013) corroborated that an uncertain economic environment influences MD through a change in the portfolio preferences by economic agents because under such circumstances, economic agents prefer to hold less risky assets and redefine their MDF.

In a similar vein, Choi and Oh (2003) was the first study to modify the MDF by incorporating economic and monetary uncertainty variables. By using the general equilibrium model, they provided the theoretical justification for including both types of uncertainties in the model. In particular, they explained that real uncertainty has negative while

monetary/nominal uncertainty has positive impact on MD in the USA. Bruggeman et al., (2003) scrutinized the impact of output volatility on MD for the Euro area and provided the evidence that economic uncertainty remains insignificant. Atta-Mensah (2004) computed an index of macroeconomic uncertainty and utilized cointegration approach to establish a significant role of real uncertainty in determining MD in Canada. Similarly, Greiber and Lemke (2005) supported Friedman's hypothesis by providing an affirmative effect of nominal uncertainty on MD for the USA and the Euro Area.

Cronin and Kennedy (2007) examined the effect of macroeconomic and monetary uncertainties on MDF for the USA by employing Granger-causality. The results indicated that only macroeconomic uncertainty Granger causes MD while monetary uncertainty itself is affected by real money growth in the USA. By using the Atta-Mensah methodology, Puah (2008) provided the evidence that economic uncertainty exerts significant effect on MD (both in the short run and the long run) for Malaysia. Dahmardeh et al., (2011) provided the evidence that under the environment of economic uncertainty, individuals reduce cash holdings and prefer to hold financial assets in Iran. Bahmani-Oskooee and Xi (2011) found that uncertainty influences MD in the short run as well as in the long run, in Australia. Özdemir and Saygili (2013) also reported that money demand function performs better in presence of monetary uncertainty in case of Turkey. Bahmani-Oskooee et al., (2012) evidenced that output and monetary uncertainties have substantial contribution in defining the MDF in China. Bahmani-Oskooee et al., (2013) provided the evidence of significant but transitory impact of output and monetary uncertainties on MDF in selected emerging economies. Additionally, Özdemira and Saygılı (2013) documented that real/output uncertainty significantly affects MD which certainly makes a valid case to include an indicator of macroeconomic uncertainty to establish a stable MDF in Turkey. Bahmani-Oskooee and Xi (2014) also provided the similar evidence for Asian countries stating that both types of uncertainties exert significant influence on MD, particularly in the short run while long run effect appears significant only in few countries. They argued that in response to uncertain macroeconomic environment induced by real and monetary uncertainties, economic agents shift their portfolio choices between cash and financial assets. Bahmani-Oskooee and Bahmani (2014) assessed MDF for Korea by incorporating the element of monetary uncertainty and provided the short-and-long run evidence in support of

the Friedman's hypothesis. Bahmani-Oskooee and Satawatananon (2015) reported significant short run and long run influence of both real and nominal uncertainties in Thailand. They argued that due to uncertain real and/or monetary setup, economic agents change their portfolio choices between cash and non-cash assets and also towards less risky assets. Gan et al., (2015) demonstrated a significant impact of economic uncertainty on MDF, in a selected group of developed and developing countries. They stated that along with traditional scale variables, economic uncertainty is an important indicator for a central bank's policy decisions. Islam (2015) incorporated the role of monetary uncertainty, real uncertainty and financial services in estimating the MDF for Japan and reported significant role of both measures of uncertainty in shaping MDF in Japan.

More recently, Bahmani-Oskooeea and Baek (2017) estimated the MDF for Korea by incorporating both measures of uncertainty. They concluded that it is important to include uncertainty element while estimating the MDF as it helps in improving the stability of MDF. Moreover, the study concluded that significant impact of both measures appears only in the short run while long run impact appears significant only for economic uncertainty. El-Rasheed et al., (2017) proclaimed a significant impact of monetary uncertainty in Nigeria. They reported the evidence of unidirectional causality running from monetary uncertainty to MD. Iyke and Ho (2017) estimated MDF for Ghana by incorporating monetary uncertainty and concluded that monetary uncertainty exerts negative impact on MDF, thus refuting Friedman's hypothesis.

With reference to the literature concerning the estimation of MDF in Pakistan, its stability and response to uncertainty, it is pertinent to mention that the empirical studies are confined to only estimating traditional MDF and to explore the stability of this function. In this regard, Akhtar (1974) and Abe et al., (1975), Mangla (1979), Khan (1980) are the pioneering studies. Later on, Nisar and Aslam (1983), Saqib and Ahmed (1986), Cornelisse et al., (1989), Khan and Hossain (1994) have applied co-integration tests and provided important contribution in the literature. Specifically, Hossain (1994) documented the absence of any significant relationship between broader MD and selected variables (output and interest rate). Khan and Ali (1997) also presented mixed findings as the cointegrating relationship between MD and selected macroeconomic aggregates such as income, inflation and interest rate appears as conditional on the definition of MD. They also concluded that monetary

authorities should consider broader definition of MD while devising monetary policy. Tariq and Matthews (1997) provided little support for supremacy of divisia index on the simple sum of monetary aggregates in case of Pakistan. Sarwar, Hussain, and Sarwar (2010), on the other hand, argued that money demand appears more stable when divisia monetary index are used as policy measure as compared to simple monetary aggregates. Ahmad and Munirs (2002) found that inflation plays more important role than interest rate in defining MDF in Pakistan. Other contributions, in this regard, include Qayyum (2005), Khan and Sajjid (2005), Azim et al., (2010), Faridi and Akhtar (2013), Anwar and Asghar (2012), and Sarwar et al., (2013). More recently, some interesting findings are provided for MDF by few studies. Financial development, for example, has been noted by Ahad (2017) as a significant short- and long-run contributor to Pakistan's money demand function. Through Bayesian statistical inference, Akbar (2021) found that inflation uncertainty shapes MDF significantly, but exchange rate volatility has no effect on MD in Pakistan. Over the period 1974-2019, Hannan and Ishaq (2021) explained that the exchange rate has an asymmetric effect on the MDF in Pakistan. Thus, the findings of these studies have substantial differences from one another which may be attributed to time frame, choice of regressors, and estimation technique. However, one important aspect of all Pakistan-specific studies is that none of them has strived for quantifying the role of any uncertainty in money demand function.

By reviewing the existing literature, two important conclusions can be drawn. Firstly, it is immensely important to incorporate the uncertainty element while estimating MDF as the literature vastly supports the Friedman's hypothesis. Secondly, the empirical literature in Pakistan is limited to estimation of traditional MDF which creates a dire need to plug in one or two uncertainties in the model to examine stability of the MDF in Pakistan. Consequently, our study is designed to figure out how economic and monetary uncertainties affect MDF in Pakistan.

3. Data and Methodology

In the existing relevant literature, MD is commonly enunciated as a function of a scale variable (i.e. real income) and opportunity cost (i.e. interest rate and inflation rate) of holding money. Furthermore, the integration of domestic financial market with international financial markets has created the possibility of currency substitution, making a solid case for considering exchange rate in the MD model (Mundell, 1963). Following Choi and Oh (2003) and Bahmani-Oskooee et al., (2015), our econometric model of demand for money incorporates economic uncertainty (proxied by output uncertainty) and monetary uncertainty (money supply uncertainty) as main regressors. Thus, our regression model is specified as:

$$LM_t = \theta_0 + \theta_1 LY_t + \theta_2 R_t + \theta_3 INF_t + \theta_4 LEX_t + \theta_5 VY_t + \theta_6 VM_5 + u_t \quad (1)$$

In specification (1), LM indicates natural log of monetary aggregate(real M2), LY refers to natural log of real income (i.e. real GDP), R is interest rate (i.e. call money rate), INF shows inflation rate (percentage change in consumer price index), LEX refers to natural log of nominal exchange rate (i.e. value of Pakistan's rupee in terms of the US dollar), VY indicates economic uncertainty proxied by the volatility of real GDP while VM represents monetary uncertainty, computed through the volatility of nominal money supply. Specifically, volatility of both the series is captured by the logarithm of the standard deviation of real GDP and nominal money supply. u symbolizes white-noise error term, and t stands for time period.

It is pertinent to mention that, by following Bahmani-Oskooee and Xi (2011), we have incorporated two types of opportunity cost in the model, namely, inflation rate and nominal interest rate. The first captures the opportunity cost of holding money against real assets while the latter measures the opportunity cost against other financial assets. Similarly, Bahmani and Kutan (2010), Bahmani-Oskooee and Bahmani (2014) also suggested to include opportunity cost measure(s) in money demand function. In addition, Mundell (1963) and Arango and Nadiri (1981), Bahmani-Oskooee, Kutan, and Xi (2013), and Bahmani-Oskooee and Bahmani (2014), among others suggested to include exchange rate in money demand function in order to measure the currency substitution effect. These three measures are particularly important in determining

MD in Pakistan because Pakistan has witnessed fluctuating trends of inflation rate which had certainly affected the public preference over various real assets and money. Furthermore, Pakistan moved from a fixed to a managed-flexible exchange rate system from 1981 onwards, resulting in exchange rate fluctuations, which justified the inclusion of exchange rate in the money demand function to measure the substitution effect between local and foreign currencies.

We expect θ_1 to be positive, in line with the views of the classical economists and Keynes, indicating that a rise in MD is linked to a positive change in real income. The public would choose accumulating financial assets to holding money at high interest rates. Similarly, holding of real assets would be preferred to holding money by the public in a high inflationary environment. So, we are expecting θ_2 and θ_3 to be negative. The nominal exchange rate accounts for the elasticity of substitution between local and foreign currencies. A nominal depreciation of local currency in terms of a foreign currency is likely to cause expectations of future depreciation, which can give rise to an intertemporal substitution of foreign currency for local currency. Alternatively, domestic currency appreciation against foreign currency tends to decrease the value of publicly owned foreign assets, thus reducing the public's wealth and demand for money. Therefore, we consider θ_4 either to be positive or negative. Finally, θ_5 and θ_6 can carry positive or negative signs. If uncertainty persuades individuals to be more cautious and keep more liquid assets, sign of its coefficient would be positive. Nonetheless, uncertainty can induce the public to make intertemporal substitution of other less volatile assets for money. Therefore, under a condition like this, the coefficient of the uncertainty measure will carry a negative sign. Thus, θ_5 and θ_6 may be positive or negative, as these are conditional on the behavior of public i.e. how they acquire assets during times of economic and monetary uncertainties.

The study covers the time period from 1975 to 2018. Data on monetary aggregate (M2), GDP, inflation rate are gathered from the World Development Indicators by the World Bank. Data on interest rate, GDP Deflator and nominal exchange rate are accessed from the International Financial Statistics published by the International Monetary Fund.

The selection of a suitable econometric methodology is one of the critical steps in an analytical research to obtain well-specified and precise outcomes. The basic aim of the present study is to test the stability of MDF by incorporating measures of economic and monetary uncertainty in the short run and the long run. The present research, therefore, uses Autoregressive Distributed Lag (ARDL) technique developed by Pesaran et al., (2001) to evaluate short run and long run relationship between MD and all the explanatory variables given in model (1). Not only does this estimation method yield both short run and long run parameter estimates of all the regressors at once, but it also has the potential to produce consistent results even in case of a small sample size like ours. In addition, this econometric framework may also be efficiently applied regardless of the fact that the regressors are integrated of order zero i.e.I(0) or integrated of order one i.e.I(1) or a combination of both I(0) and I(1). Furthermore, Bahmani-Oskooee and Tanku (2008) proclaimed that the order of integration for different volatility measures can be different, therefore, using ARDL technique for estimating model (1) is appropriate. The ARDL technique leads to the estimation of dynamic Error Correction Model (ECM) which includes short run dynamics as well as long run equilibrium without a compromise on long run information being misplaced (Nkoro and Uko, 2016).

As equation (1) pertains to long run perspective only, so it seems imperative to integrate short run dynamics of money demand function into our analysis as well. To this end, the ECM specification of model (1) shall be estimated as follows:

$$\Delta LM_t = \alpha_0 + \sum_{i=1}^{n} \alpha_1 \Delta LM_{t-i} + \sum_{i=0}^{n} \alpha_2 \Delta LY_{t-i} + \sum_{i=0}^{n} \alpha_3 \Delta R_{t-i} + \sum_{i=0}^{n} \alpha_4 \Delta INF_{t-i} +$$
$$\sum_{i=0}^{n} \alpha_5 \Delta LEX_{t-i} + \sum_{i=0}^{n} \alpha_6 \Delta VY_{t-i} + \sum_{i=0}^{n} \alpha_7 \Delta VM_{t-i} + \beta_0 LM_{t-1} + \beta_1 LY_{t-1} + \beta_2 R_{t-1} + \beta_3 INF_{t-1} + \beta_4 LEX_{t-1} +$$
$$\beta_5 VY_{t-1} + \beta_6 VM_{t-1} + e_t \qquad (2)$$

Using a linear combination of all lagged-level variables as a proxy for the lagged error correction term (ECT) from equation (1), Pesaran et al., (2001) suggest that both short run and long run effects could be gauged in one phase. In equation (2), the coefficients attached to difference operators indicate short run dynamics while the terms attached to first lag reveal the long run relationships. The null hypothesis of no cointegration

(i.e. $\beta_0 = \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = \beta_6 = 0$) is tested against the alternative hypothesis of the existence of cointegration (i.e. $\beta_0 \neq \beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq \beta_5 \neq \beta_6 \neq 0$

For this purpose, Pesaran et al., (2001) proposed the familiar *F*-test with the novel critical values they tabulated. Therefore, F-tests are employed to test the prevalence of long run relationships. In case the value of computed F-statistic appears outside the critical bounds, a clear conclusion can be drawn concerning the cointegration regardless of the order of integration of the regressors. Pesaran et al., (2001) proposed two groups of critical values which offer critical value bounds for all categories of the regressors i.e. purely *I*(1), purely *I*(0) or a combination of both.

Table 1: Unit Root Test Results

Variable	Test Statistic		Critical Values at 5% Level of Significance	Order of Integration
	At Level	At First Difference		
LM	-2.744	-4.471	-3.190	I(1)
LY	-0.555	-4.894	-3.190	I(1)
R	-3.378	-	-3.190	I(0)
INF	-3.866	-	-3.190	I(0)
LEX	-1.978	-5.460	-3.190	I(1)
VY	-5.301	-	-3.190	I(0)
VM	-4.784	-	-3.190	I(0)

4. Empirical Results

4.1. Unit Root Test

Though the ARDL approach does not have a pre-requisite of testing the variables to establish their stationarity status, it does require that the variables should not be stationary at second-difference. Hence, we perform the stationarity check using the Dickey-Fuller Generalized Least Squares (DF-GLS) test. The DF-GLS test has non-stationary null hypothesis. The results obtained using the DF-GLS test are presented in table 1. The estimates portray that real money balances i.e. demand for money, real GDP and nominal exchange rate are stationary at first-difference. However, interest rate, inflation rate, economic uncertainty and monetary uncertainty are stationary at level. The mixed order of

integration of regressors justifies the use of ARDL technique. Therefore, we can proceed to estimate the specifications (1) and (2).

4.2. Bound Test for Cointegration

After selecting the optimal lag length by using the Schwartz Bayesian Criteria, value of F-test statistic is estimated to test the null hypothesis of no cointegration in case of equation (2) as an initial crucial step (see table 2). A comparison between the calculated value of F-test statistic with that of its critical counterpart as provided by Pesaran et al., (2001) reveals that null hypothesis of no cointegration between money demand and all the regressors is rejected. Hence, it turns out that economic and monetary uncertainties along with other explanatory variables form a long run relationship with money demand in Pakistan.

Table 2: Bound Test for Cointegration Results

Dep. Variable	**Independent Variable**	**F-statistic Value**	**F-statistic Critical Value (5% Significance Level)**		**Outcome**
			I(0)	I(1)	
LM	LY,R,INF,LEX,VY,VM	8.02	2.87	4.00	Cointegration

4.3. Demand for Money: Long Run and Short Run Estimates

Given the evidence of cointegration between MD and both uncertainty measures, we move to the long run estimates of model (2) displayed in table 3. As depicted from table 3, income level portrays a positive impact on MD with statistical significance at the conventional level. This outcome is in accordance with the notion of transaction demand for money motive postulated by Keynes (1936) that increase in economic activity produces higher income level which ultimately induces people to increase their transaction level. Thus, due to transaction motive, demand for money increases. This finding also corroborates with the empirical evidence documented by Ahmad and Munirs (2002) and Azim et al., (2010), for Pakistan.

The coefficient of interest rate is statistically significant and it carries a negative sign. Hence, it can be concluded that the responsiveness of MD towards interest rate is negative which is in accordance with our prior expectation. The other indicator of opportunity cost of holding money,

namely, inflation rate also appears as a significant predictor of MD. It adversely impacts MD, proposing that real assets operate as an alternative to cash holdings in Pakistan. A comparison between the magnitude of interest rate and inflation rate reveals that a high inflation rate is a stronger incentive to economize on monetary balances than the incentive provided by a high interest rate in Pakistan. Similar type of outcome has been reported by Ahmad and Munirs (2002) in case of Pakistan.

MD responds positively and significantly to exchange rate, suggesting that the wealth effect takes place in the long run in Pakistan. Arango and Nadiri (1981) delineated that domestic currency depreciation causes an increase in the domestic value of foreign assets thereby increasing the wealth. Hence, wealth effect triggers consumption and money demand. Specifically, an increase in exchange rate increases the monetary value of foreign assets held by residents of a nation, hence increasing their wealth. In order to maintain the fixed share of their wealth in indigenous assets, the asset holders are expected to repatriate a proportion of their foreign assets into domestic assets. Thus, a higher demand of domestic currency in response to currency depreciation is reported through the wealth effect. This finding is substantiated by Ghumro and Karim (2016) for Pakistan. Nonetheless, this outcome contradicts with what has been found by Hossain (1994), Anwar and Asghar (2012) and Azim et.al.,(2010) in the context of Pakistan.

Finally, we move to discuss the impact of our focus variables, namely, economic uncertainty and monetary uncertainty. It is observed that in response to economic uncertainty, the demand for money significantly reduces in Pakistan. This finding advocates that individuals are likely to increase their holding in favour of valuable alternative assets (for instance, gold or real estate) in place of cash balances and thus avoid staying liquid during times of economic uncertainty in the long run. This result substantiates the stance of Atta-Mensah (2004) that economic agents are expected to hold safer (less risky) assets in any uncertain economic situation. The outcome is also supported by some other empirical studies such as Choi and Oh (2003), Dahmardeh et al., (2011), Bahmani- Oskooee and Baek (2017), and Tan et.al.,(2020).

The coefficient of monetary uncertainty appeared statistically significant with positive sign, indicating consistency of Friedman's (1984) volatility hypothesis that an increase in monetary growth volatility creates

uncertainty which results in a rise in MD. This result advocates a precautionary effect where the economic agents prefer to hold more cash balances and thus staying liquid during times of monetary uncertainty. In other words, individuals are more inclined towards accumulating liquid assets to buffer against an unpredictable future created by monetary uncertainty. This finding is also supported by Choi and Oh (2003), Bahmani-Oskooee and Bahmani (2014), Bahmani- Oskooee and Baek (2017), and El-Rasheed et al., (2017). As can be seen from table 3, money demand is relatively more sensitive to changes in economic uncertainty as compared to changes in monetary uncertainty in the long run.

Table 3: Demand for Money: Long Run Estimates

Dependent Variable: LM Selected Model: ARDL (2,1,1,2,2,1,1)		
Regressor	**Coefficient**	**t-value**
LY	0.934**	2.214
R	-0.038***	5.433
INF	-1.137***	-3.887
LEX	0.249***	5.846
VY	-0.107***	-3.195
VM	0.056*	1.943

Note:***, **and * indicate significant at 1%, 5% and 10% levels respectively.

The short run estimates are displayed in table 4. The results highlight that, in the short run, MD is significantly influenced from the current and lagged periods of the variables. For example, demand for money is an increasing function of income level. Interest rate and inflation rate, both are negatively and insignificantly associated with demand for money. The parameter estimate of exchange rate appears negative and significant in the current period which is absolutely different from its long run counterpart which supported substitution effect phenomenon. However, we see that exchange rate affects MD positively and insignificantly in lagged one-year time period. Economic and monetary uncertainties are negative in the current period, indicating that a substitution effect from cash to assets may ensue in the short run. Overall, although the estimated results in the short run provide alternative rationale regarding MD in Pakistan yet the long run significant determinants of MD appear as income level, rate of interest, inflation rate, exchange rate, and both measures of uncertainty.

Table 4: Demand for Money: Short Run Estimates

Dependent Variable: D(LM) **Selected Model: ARDL (2,1,1,2,2,1,1)**		
Regressor	**Coefficient**	**t-value**
Constant	2.514***	8.118
@Trend	0.116***	7.084
DLM(-1)	0.415***	5.337
DLY	0.094**	2.162
DR	-0.014	-1.266
DINF	-0.161	-0.843
DINF(-1)	-0.098	-1.384
DLEX	-0.067**	-5.068
DLEX(-1)	0.085	1.394
DVY	-0.014*	-1.854
DVM	-0.022***	-4.661
ECT(-1)	-0.656***	-7.049
Diagnostic Tests		
χ^2_{SC}	0.388(0.681)	χ^2_H 0.704(0.463)
F_{FF}	0.898(0.302)	χ^2_N 1.757(0.468)

Note:***, **and * indicate significant at 1%, 5% and 10% levels respectively.
χ^2_{SC}, χ^2_H and χ^2_N denote LM test for serial correlation, heteroscedasticity, and normality respectively. F_{FF} denotes Ramsey's RESET test statistic.
The associated p values are in parentheses

The estimated result of the lagged ECT is in accordance with our prior expectation i.e. negative with significance at one percent level, which refers to the speed at which an adjustment takes place to restore the equilibrium position in case of any disturbance in the long run. Its coefficient value i.e. 0.656 infers that to restore long run equilibrium in the dynamic model (2), approximately 66 percent adjustment from the preceding year to the current year will be carried out. In other words, a reasonably good rate of convergence to long run equilibrium is indicated by the estimated coefficient of the lagged ECT.

Furthermore, at the bottom of table 4, results of four diagnostic tests for the estimated model are displayed. The estimated model is free from four econometric problems, namely, serial correlation, heteroscedasticity, functional form's misspecification and non-normality of the residuals. To test the structural stability of the estimated parameters of the model (2), cumulative sum (CUSUM) and cumulative sum of squares (CUSUMQ) plots are given in fig. 1 and fig.2. Both of them lie within the critical bounds of 5% level, suggesting parameter stability of the estimated model

(2). Thus, it is evident that a stable long run demand for money function is consistent with Pakistan's data with the inclusion of economic and monetary uncertainties in the empirical analysis.

Figure 1: Plot of Cumulative Sum of Recursive Residual

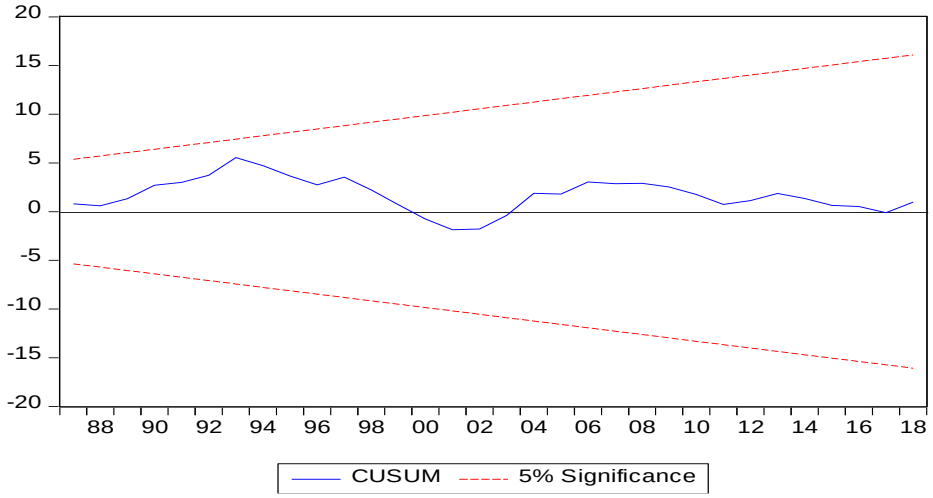
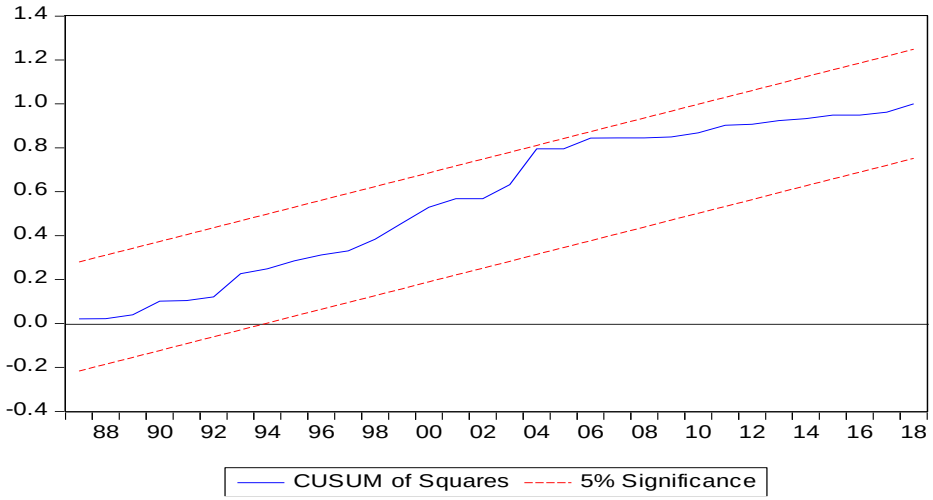


Figure 2: Plot of Cumulative Sum of Squares Recursive Residual



5. Conclusion

Attaining stability in the demand for money is indispensable for policy-makers, chiefly because it is pivotal for choosing appropriate monetary

policy arrangements. In addition, the impact of monetary policy on macroeconomic aggregates such as output, inflation, and exchange rate are better predicted under stable money demand function. Therefore, examining demand for money function and its fundamental determinants is generally seen as a vital underpinning in macroeconomic theory that is important for monetary policy and it has paved the way for emergence of vast theoretical and empirical literature across the world.

Following the theoretical underpinnings, there is a huge surge in the empirical literature examining the determinants of money demand function, and most recently examining the role of uncertainty in money demand function and its stability across countries. Unfortunately, we have not come across any empirical investigation which has attempted to quantify the role of any measure of uncertainty in money demand function in the context of Pakistan. The basic motivation behind the present study is, therefore, to estimate an open economy version of money demand function which also treats economic uncertainty and monetary uncertainty as regressors during the time period from 1975 to 2018 in case of Pakistan.

By employing the ARDL technique the study finds that the level of income, interest rate, inflation rate, and exchange rate are significant determinants of money demand in Pakistan. As far as the two measures of uncertainty are concerned, it is found that in the short run, economic and monetary uncertainties adversely impact demand for money which implies that the individuals prefer to avoid staying liquid in a situation of economic uncertainty and monetary uncertainty. However, in the long run, economic uncertainty is negatively associated with money demand while the effect of monetary uncertainty is positive on demand for money. Therefore, individuals tend to increase their holdings in favour of valuable alternative assets in place of cash balances during times of economic uncertainty in the long run. However, the positive relationship between monetary uncertainty and money demand suggests that economic agents prefer to hold more cash balances during times of monetary uncertainty. This finding confirms the consistency of Friedman's hypothesis with Pakistan's data in the long run. Alternatively, the individuals are more inclined towards accumulating liquid assets to buffer against an unpredictable future created by monetary uncertainty. It is important to note that the stability tests used by the study indicate long run stability of the model. Hence, it can safely be stated that in presence of both the

measures of uncertainty, money demand function becomes stable in the context of Pakistan.

Based on the findings of the study, it is suggested that economic stability policies should be selected by the policy-makers keeping in view the short run and the long run effects of economic uncertainty and monetary uncertainty on money demand in Pakistan. This type of strategy will be fruitful for creating a stable economic and monetary environment for accelerating the pace of business and production activities in the country. Moreover, the study recommends that the similar exercise may be carried out with high frequency data. Similarly, alternate measures of monetary and real sector uncertainty may also be used to test the robustness of findings provided by existing literature.

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