Measuring the Money Demand in Pakistan: A Time Series Analysis

Roussel, Yannick and Ali, Amjad and Audi, Marc

European School of Administration and Management (ESAM)-France., European School of Administration and Management (ESAM)-France. Lahore School of Accountancy and Finance, University of Lahore, Pakistan., European School of Administration and Management (ESAM)-France. University Paris 1 Pantheon Sorbonne-France.

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Yannick Roussel[1], Amjad Ali[2], Marc Audi[3]

Abstract
This study has explored the factor impacting money demand in the case of Pakistan from 1980 to 2019. Broad Money is taken as the dependent variable, consumption of the household, consumption of government, interest rate, consumer price index, population growth, and remittances are selected independent variables. Augmented Dickey-fuller (ADF) and Phillip Perron (PP) unit root tests are used for examining the stationary of the variables. ARDL method is used for finding the cointegration among the variables of the model. Granger Causality test is used for examining the causal relationship among variables. The results of this study show that there is mixed order of integration among variables of the model. The estimated results of the study show that socio-economic factors play an important role in determining the money demand in Pakistan. So, socio-economic factors play an important role in determining money demand in the case of Pakistan.

Keywords: Money demand, consumption, interest rate, population growth, remittances
JEL Codes: P44, E21, P23

I. Introduction

Normally, money is considered the stock assets which make daily transactions easy for businesses, firms as well as households. Neo-Classical economists propose that money demand depends upon nominal income GDP, the expected rate of return on money, bonds, equities, and durable goods. Piguo (1917), Marshall (1923), and Alfred (1923) focus on the cash balance approach. Keynes (1936) mentions that money impact income via interest rate and calls it Liquidity Preference. He recommends three reasons for the demand for money in an economy: transactional, speculative, and precautionary demand for money. He further mentions that transactional and speculative demand for money has a positive relationship with income whereas precautionary demand for money has a negative relation with interest rate. Further post-Keynesian economists examine the relationship among real money demand, real earnings, and the real rate of interest (Sober, 2013). Baumol (1952) observes the influence of interest bounces on transactions demand for money. He declares there is a non-linear association between income and transactional demand for money; this means more changes have occurred in transactional demand for money when there is a minor change in income. Tobin (1956) mentions that the Liquidity Preference function does not explain the elasticity of the expected interest rate. Tobin (1956) considers expected return the main indicator of money demand. Friedman (1956) presents a function of money demand and calls it real money balance. Demand for money is a very important element for manipulating macroeconomic and financial policies in developed as well as developing countries (Sriram, 2001). Money is an important and optimal tool for the transitional objectives of monetary policy. Stable money demand is necessary for macroeconomic policy analysis. The traditional theories of closed economy mention money demand function are designed by national income, interest rate, and opportunity cost. In open economy financial liberalization, many may be another factor of the money demand model (Tang, 2010).

Several studies examine the determining factors of money demand in the case of Pakistan such as Sarwar et al., (2010), Khan and Hye (2011), Anwar and Asghar (2012), Abdullah (2013), Safdar and Khan (2014), Munawar and Iqbal (2015) etc. These studies focus on income, interest rate, foreign exchange rate, and inflation as determinants of money demand. They ignore the social sector impact on money demand in the case of Pakistan. This study uses both socio-economic variables for examining the money demand in Pakistan. This type of study is hardly available in the case of Pakistan. In these studies, the reliability of interest rate decides money demand stability, as the interest rate has more fluctuating data within time (Haider et al., 2013). In previous studies mostly interest rates and real GDP are the main determinants of money demand. But recently some studies use exchange rate, inflation, consumption and investment expenditure, exports, and stock price as determinants of money demand. The solidity and detailed money demand function plays an active role in economic progress. The current study is finding socio-economic factors of money demand in Pakistan which are useful to determine the active monetary policy for achieving goals. This study is using household and government consumption, amount of remittances, population growth, interest rate, and consumer price index. It will guide State Bank to evaluate monetary policy in Pakistan. This study is noteworthy because it has tried

[1] Rector; European School of Administration and Management (ESAM)-France.
[2]Associate Researcher; European School of Administration and Management (ESAM)-France. Assistant Professor at Lahore School of Accountancy and Finance, University of Lahore, Pakistan.
[3] Provost/ Director of Academic Affairs at European School of Administration and Management (ESAM)-France. University Paris 1 Pantheon Sorbonne-France.

to overcome the weakness of existing work which is available at the national and international level. This is very helpful for other researchers who want to study money demand function in Pakistan. This study would be a healthy contribution to the respective literature.

II. Literature Review

Hurley and Guiomard (1989) check the stability of money demand M1 and M3 in Ireland between 1971 to1988. This study has collected data of 11 simple variables for empirical analysis. Johnsen co-integration and Augmented Dicky Fuller (ADF) techniques are used for empirical analysis. The results show that money demand is not stable in Ireland in 1971-1988. There is some statistical measurement error in the empirical analysis. Simmons (1992) studies the money demand function of five African countries and domestic interest rate, depreciation; expected exchange rate, and inflation are used as independent variables. The show that interest rate and inflation have a negative relationship with money demand in selected countries. Whereas the exchange rate has a confident and noteworthy relationship with money demand in selected African countries. Hossain (1994) uses annual data from 1951 to1991 and estimates the money demand function. Johansen co-integration test is used for empirical analysis. The results show that there is a co-integrating among output and actual money balances. While the results for the subsample 1972-1991 for real output, real money balances, and market call interest rate shows there are two integrating vectors. This study shows that the stability of M1 is higher than M2 demand and this study suggests that for monetary targeting in Pakistan M1 should be used.

Khan (1994) checks the impact of reforms in the financial sector on the money demand in Pakistan by using quarterly statistics from 1971 to 1993. He uses the error-correction technique of co-integration for the analysis of the money demand model. The study explores that M2 demand is affected by the inflation rate, real interest rate, actual profits, and flexible rate of interest. While M1 is co-integrated with an interest rate, truthful earnings, and high prices but not with minor and middle-interest rates. The study shows that monetary policy is stabilizing since the early 1990s. Kogar (1995) examines the extensive stability of the demand for money in Turkey and Israel. This study uses quarterly time series data from 1978 to 1990 and 1977 to 1988. The results of the co-integration method show that the money demand function is stable in both countries. All the independent variables of the model have a significant impact on money demand. Qayyum (1998) studies a long-run association between the demand for money and bond ratio, income, and inflation rate in the case of Pakistan. The rate of interest on deposit and inflation rate has an important correlation with money demand in the case of Pakistan.

Khalid (1999) estimates the long- and short-term money demand function (M1 also M2) in South Korea, the Philippines, and Singapore. Domestic income and foreign interest rates are used for explaining the money demand function. For analysis, quarterly time series data is used. This study presents that income and proxy variables (expected exchange proportion depreciation) show a very significant part of these Asian countries. The local interest rate has an insignificant and overseas degree of interest has a significant influence on money demand function except for the Philippines. Christopher Adam (2000) uses the Johansen cointegration method to find a long-run association between physical currency balances and real money balances for 1986-2000. This model is based on an invincible trend of stationery which has made a strong single equation possible. The relative stability in the model is confirmed by the error correction model. Sriram (2001) summarizes all money demand studies which are conducted in the case of developing countries. He explains that variable nature, data collection period, and data source, and econometric technique are playing roles in determining the money demand function. This study provides the basic instrument for further studies about money demand function.

Anoruo (2002) uses the co-integration test for expressing the broad money demand function (M2) in Nigeria during the Structural Adjustment Program. In this study quarterly data from IFS from 1986 to 2000 is used. The results demonstrate that real discount rates and economic activates help determine the broad money demand. CUSUM and CUSUMSQ stability tests prove that demand for money is stable during SAP. According to this study broad money demand is a very essential element for explaining the monetary principle in Nigeria. Mutluer and Barlas (2002) test the long-run association between money demand, tangible assets, and the interest rate on deposit and public safeties, inflation, and existent exchange rate. For this Turkish narrow and broad money from 1987 to 2001 is used. They find that interest on the deposit and government securities have a direct and inverse relation with money demand respectively. Inflation and exchange rate coefficient result are converging in the long run.

Artis and Beyer (2003) assess the money demand in Europe from 1983 to 2000. This study suggests that money demand is constant in all vectors. The association between the demand for money, GDP, and opportunity cost has unitary elasticity. Money replacement does not show an imperative performance in long run for determining the money demand. Choi and Oxley (2004) find the short and long-run money demand (M3) model for New Zealand. Income, price, and interest rate are used for explaining money demand. Error correction terms and co-integration techniques are applied to quarterly data from the period 1988 to 2000. They collect data from the New Zealand time

series and PC-Infos database. In long run, all explanatory variables play a significant role in the operation of monetary policy. They use three seasonal dummies for the explanation of the short-run model. The results are helpful for Reserve Bank Monetary Policy in New Zealand. Halicioglu and Ugur (2005) find that there is a stable money demand model in developing countries. If stable money demand exists then monetary uncertainty decreased and financial goals are increased. The results of ARDL show all the independent variables have a significant impact on demand for money both in the long and short-run periods. Khan and Sajjid (2005) explore the link among actual money demand, actual revenue, increase in the price level, rate of exchange, and rate of interest by using quarterly data from IFS for 1982-2002 in Pakistan. ARDL method is employed for empirical analysis. Results of this study indicate that real income, inflation, rate of exchange, and rate of interest significant influence on demand for money in the long run. In the short run, the change in these variables is less as compared to the long run. This study also suggests that money demand is stable during this period.

Qayyum (2005) examines money demand M2 of Pakistan during 1960-1999. The study explores that there is a long-run correlation between M2 and real earnings, call money rate, inflation proportion, and government bond yield. The empirics show that in the short run, the main determinants are income and rate of interest. The money demand model is stable so it could be used for policy investigation in Pakistan. Valadkhani (2005) analyzes the stability of the money demand function based on the quarterly data set of 1976 to 2002 in Australia. The impact of all determinants is quantified both in the long and short run. Empirical findings of on Johansen test highlight that the money demand model is co-integrated. Income has unit elastic and inflation has a direct effect on broad money. Hussain et al., (2006) estimate the demand for money for 1972-2005 of Pakistan. In this study annual time series data is collected from the State Bank of Pakistan (SBP). The long-run demand for money function M0, M1, and M2 is estimated by OLS. The study shows that for Pakistan M2 is the most appropriate money demand function. The long-term income elasticity is varying from 0.74 to 0.79 in all three money demand functions. Financial innovation plays a very important role in explaining the monetary policy of Pakistan. Haug (2006) investigates the money demand function of Canada. The analysis was done from 1972 to 1997. This study accompanied too much larger period first, started from 1872 and second, started from 1957 and also included M0, M1, and M2 in the model. By employing PIC (Posterior information criteria) and cointegration rank stability test, before structural breaks, the results suggest a significant relationship between M1 and interest rate. But after the structural breaks, M0 and interest rate are significant. This study prefers to simple equation model as compared to the full information method.

Sharifi (2008) applies the ARDL procedure to evaluate the money demand (M1) function in Iran. This study collects periodical data of the Consumer Price Index from the State Bank of Iran from 1985 to 2006. The results show that the money demand function is stable in Iran during this period. The coefficients of income and exchange rate are ensuring progressive and noteworthy signs. The inflation coefficient has a negative sign that supports the previous studies. This study also suggests that M1 is a very important factor of monetary strategy and central bank mechanism. Sovannroeun (2008) investigates the factors that derive the money demand to Cambodia. Money demand is very helpful for policymaking. For this purpose, he uses monthly data analysis from IFS for 1994 to 2006. Results show that inflation is an important factor in determining the level of money demand stability in Cambodia. Output, inflation, and exchange rate coefficient has positive and significant impact on money demand. Valadkhani (2008) applies ARDL and Engle-Granger approaches to assess the characteristics of demand for money M2 in selected Asian countries. Annually panel data of 146 observations are used in this study from 1975 to 2002. Results determine that money demand and their determining factors are co-integrated to each other in long run. Empirically, income is more elastic in all selected Asian countries. Capital mobility and currency substitution are explaining long-run money demand. In the short run income, inflation, and rate of interest have a significant impact on money demand. Azim et al., (2010) estimate demand for money (M2) function in Pakistan by using annual data for 1973-2007. ARDL method is applied for the co-integrational link between the selected variables of the model. Results of this study show that money demand is stable from 1973 to 2007. The inflation relationship and income, and exchange rate elasticity have a positive and negative association with demand for money respectively. Kumar (2010) examines money demand function as well in Eleven OECD countries for 1975 to 2008. A fully modified OLS (Pedroni technique) is used for empirical analysis. The findings show that income has a positive influence on money demand but the rate of interest has a negative effect after the structural change in 1985. The study finds that money demand (M1) is stable in both periods.

Bashier and Dahlan (2011) estimate the vital role of the demand for money function of Jordan. They use unit root ADF, IRFs, VDC approach, and co-integration tests on time series data from 1971 to 2009. They find income has positive and significant on demand for money whereas exchange rate depreciation has a negative and significant influence on demand for money in Jordan. Dobnik (2011) finds the money demand function of eleven OECD countries from 1983 to 2006. Data is composed of national accounts and a financial indicator dataset. Income and rate of interest are directly and inversely related to money demand respectively. Whereas, the flexibility of money is very important as compared to income elasticity's which means money regulates the global relationship as compared to state-level

equilibrium. Dagher and Kovanen (2011) investigated the impact of money demand on the economy in the case of Ghana. For this analysis, they use time-series data from Ghana Statistics Services. For empirical analysis unit root, ADF, and co-integration ARDL tests are used. This study suggests that in Ghana money demand stability is converging in the long run. The results confirm that money demand has an important effect on all sectors of the economy. Suliman and Dafaalla (2011) observe the demand for money function in Sudan for the duration of 1960-2010. ARDL co-integration technique is applied for the long-run association between variables. Annual data is collected from the Central bank of Sudan. The estimated long-run results show all the selected variables have significant relation with dependent variables. Inflation and exchange rate have an undesirable effect on money demand and people demand substitution assets. In Sudan, narrow money demand is used for monetary policy analysis.

Anwar and Asghar (2012) investigate the factors of money demand which are helpful for effective monetary and stabilization policies in Pakistan. This study uses annual data from World Bank Indicators and State Bank of Pakistan from 1975 to 2009. For empirical analysis, Auto-Regressive Distributed Lag (ARDL) is used. ADF and PP techniques are applied for examining the stationary of the variables. Results indicate that the long-run relationship with real money balance (M1) is unstable and real money balance (M2) is stable for policymaking. The inflation rate and exchange rate coefficients are negative and significant. Income elasticity has a positive and significant effect on both real money balance M1 and M2. M2 real monetary has a negative and significant association with inflation but insignificant in the case of the exchange rate. Arize and Nam (2012) examine the connection between exchange rate and money demand for 1973-2007 for seven countries. The results show that the exchange rate has constructive relation with demand for money while the domestic interest rate hurts money demand in all seven countries. The study concludes that broad money (M2) is needed by monetary authorities for achieving valuable goals. Chaudhry et al., (2012) apply the co-integration and Granger Causality technique to estimate the impression of monetary policy and inflation on economic progress in the case of Pakistan. This study analyses time series data from 1972-2010 which is collected from World Bank and International Financial Statistics. In the short-run, the only budget deficit has a significant relationship with money demand. According to the Granger Causality test, real GDP and exchange rate has a bidirectional causal relationship. But real GDP is causing financial depth, domestic credit, and budget deficit uni-directionally. Exchange rate causing financial depth and budget deficit in the case of Pakistan during the selected period. Sichei and Kamau (2012) examine money demand in Kenya by using quarterly data from 1997 to 2011. Unit root ADF and PP, cointegration VAR model are applied to estimate the model. Results indicate that the demand for money model is unbalanced in line with implying the current stable monetary policies. Net domestic assets, inflation, and interest rate have a noteworthy connection with stable demand for money in the short run.

Abdullah et al., (2013) find co-integration between the determinants of money demand in Pakistan. Household consumption, investment, export, government expenditures, and GDP deflator are the selected determining element of demand for money in Pakistan. This study use data from 1972-2010 and data of all variables are collected from World Bank databases. The estimated results of the study show that there is co-integrational relation existed among money demand and its determining factor. Money demand is directly affected by household, investment, and export expenditure in long run but it is inversely affected by government expenditure and prices level both in the short and long run in Pakistan. In long run, the coefficient of investment expenditure is higher and the price coefficient is lower as related to other variables. In the short run household and export expenditure have insignificant and investment has a significant impact on money demand. The time trend performs an important role in defining the demand for money mode in Pakistan. Dharmadasa et al., (2013) check the power of world financial crises on money demand function in Sri Linka. ARDL method is used for measuring the long-run affiliation of demand for money function and its selected factors. Granger causality method is also used for examining the causal association among variables. The results that in long run all variables have a significant impact on the demand for money. Granger test empirics display that all selected variables have a causal relationship among money demand in the case of Sri Lanka.

Faridi and Akhtar (2013) examine the relationship between real money demand and its contributing factor. Real gross domestic product, deposit rate, exchange rate, financial improvement, and total population are used as selected determinants ARDL approach is used for empirical analysis. Data from 1972 to 2011 is used for this purpose. The results of the study show that real gross domestic product has a positive whereas exchange rates have a negative relationship with money demand in Pakistan. Financial innovation and total population lead to higher demand for money because when the population size increases then the demand for more money for business is also increased. Haider et al., (2013) investigate the demand for money function in Pakistan with the help of monetary policy. ARDL bounds testing approach to co-integration is used for empirical analysis. Money demand function M2 is used as a dependent variable whereas real GDP, industrial production index, CPI, inflation exchange rate, lending and own rate, short term and long-term risk premium are used as independent variables. The estimated results of the study demonstrate that all independent variables have a significant link with demand for money in the case of Pakistan over the selected tie period. Iyoboyi et al., (2013) design the function of money demand in Nigeria from 1970 to 2010.

ADF and PP unit roots tests are used for the stationary of the variables. ARDL bound testing method is used for examining the relationship between money demand and its contributing factors. This study indicates that the narrow demand for money model is stable in Nigeria because Nigeria is not affected by external shocks. Empirical results show that real income has a positive and significant affiliation with money demand. The results illustrate that the interest rate has a negative and significant impact on the demand for money. The error correction term is negatively and highly significant which shows the speed of regulation from the short-run toward the long-run.

Salha and Jaidi (2013) estimate the determinants of demand for money in Tunisia. Income, interest rate, and expenditures on export, investment, and consumption are the selected determinants of money demand. ARDL bound testing is used for empirical analysis. The annual time sequence data are collected from the WDI, World Bank, IMF, and National Institute of Statistics in Tunisia from 1981 to 2011. The results indicate that the demand for money function M2 remains stable due to the inclusion of nominal exchange and inflation rate. In long run, M2 money demand plays an important role in Tunisia's monetary policy regulation. The interest rate has a significant impact on money demand in the long run as well as the short run. In long run, the money demand function is affected by consumption expenditure while in the short-run it is stimulated by investment expenditure. Sarwar et al., (2013) reveal the importance of money demand on the financial sector and monetary policy for 1972 to 2007. ADF and PP unit root techniques are used for the stationarity of the variables. ARDL co-integration is used to inspect the co-integration among the selected variables. The results show that income has a positive impact on money demand whereas the opportunity cost of holding money hurts demand for money in Pakistan.

Apere and Karimo (2014) examine the demand for money function in the case of Nigeria from 1971 to 2012. The money demand model is stable instead of structural changes, financial crises, and irregular armed to public rules. Income and interest rates perform the most important role in determining the money demand function. In the short run transaction and precautionary motives have a major impact on money demand. Empirics of this study recommend that interest rates play a very important role in log-run speculative money demand. Asif and Rashid (2014) estimate the relationship of money demand ad its determinants using a partial adjustment model from 1973 to 2013. OLS and Breusch Godfrey tests are used for empirical analysis. This study finds that money demand has a significant relation with real GDP and adverse relation with the rate of interest in the short as well as long run. Kiptui (2014) re-estimates the money demand function for 2000-2013. Estimation shows that the income elasticity of M2 is lower as compared to M3 and M1 which are 0.50, 0.770, and 1.04 respectively. Depreciation of exchange rate, interest rate elasticities, inflation, and Treasury bill hurts money demand but the interest deposit has a positive impact on money demand. Simawu et al., (2014) examine the determining factors of demand for money in the case of some selected Asian Economies from 1990 to2005. GDP, rate of interest, and rate of exchange are selected factors of demand for money. The estimated outcomes of the study reveal that all selected determinants play a significant role in determining money demand. Safdar and Khan (2014) estimate the influence of ATMs and credit cards (financial innovation) on money demand function in Pakistan. This study also finds the relationship between instability in the money market and output breaks. The ordinary least square (OLS) approach is used for measuring the long-run relationship. Empirical results show that income is positively linked with money demand because when people have more income then they demand more money. The rate of interest is inversely connected to the demand for money. When the interest rate increases people do not like to hold money because people give preference to investment and saving. Therefore, ATM and credit cards also have negative signs. People would not like to hold money in their wallets due to easily withdrawal through ATM and Credit Card.

Gilal (2015) examines the connection between demand for money and rate of exchange in the case of Pakistan. He tested for the impact of the nominal exchange rate in Pakistan using Johansen co-integration and ECM techniques are used for empirical analysis. By comparing narrow and broad money he finds that M1 is co-integrated while M2 is not co-integrated with all selected independent variables. The significant nominal exchange rate explains that people demand more money M1 as per local currency is raise the value in the foreign marketplace. Munwar and Iqbal (2015) examine the money demand and money supply function from 1961-2013 in the case of Pakistan. The two-stage least square (2SLS) technique is employed for empirical analysis. Data are assembled from IFS and WDI. The results showed that there is a direct attachment between money demand and output. Demand for money is adversely linked to the rate of interest and exchange rate. Money supply illustrated that it has a negative relationship with inflation and GDP but it has a positive relationship with the rate of interest. Malumisa (2015) reports that structural break in 1994 has a significant role on money demand stability function in South Africa. He tests a narrow and broad money demand model in South Africa using World Bank and national Reserve Bank dataset for 1970 to 2013. By comparing the post and prior period of breaks Gregory Hansen's test finds that broad money demand function is not affected by these breaks. The study suggests that there is a need for liberalization of monetary policies and floating exchange rate policy in the case of South Africa.

III. The Model

According to Keynes (1973) when money is used for transactional purposes then demand for money function is directly proportional to income and inversely related to the rate of interest that is $M_t d = f(y^+ i^-)$. Precautionary demand for money function is parallel to the transactional demand for money. People can hold extra money for the defensive purpose and this money demand is positively related to income and rate of interest $M_p d = f(y^+ i^-)$. Speculative demand for money has a positive relationship with the rate of interest and the price of the bond. For checking the role of money in an economy the quantity theory of money is used. The quantity theory of money describes that there is a positive connection between price and income.

$$MV = PT \quad (1)$$

Here M is money, V is velocity means money how many hands change in a given period, P is prices of goods and services and T represents the number of transactions. When economists want to check the character of money in the economy then T is substituted by Y due to lack of transaction data such as.

$$MV = PY \quad (2)$$

If the velocity of money does not change over the period then the money demand equation become as:

$$(M/P)^d = kY \quad (3)$$

This equation represents that the number of actual money stabilities is completely connected to income and k is constant that shows how much money people are holding. According to the Cambridge quantity theory of money, the money demand function has a direct relationship with price and income.

$$M^d = kPY \quad (4)$$

In equilibrium, the magnitude of real money demand is equal to the real money supply would generally take the form of

$$(M/P)^d = (M/P)^s = (M/P) = kY \quad (5)$$

Therefore, the money demand utility can be described as:

$$(M/P) = kY \quad (6)$$

In money demand studies it is assumed that money demand has a relation with real sector economy variables (Abdullah et al., 2013 Simawu 2014). Ali (2011), Ali (2015), Ali (2018), Ali and Bibi (2017), Ali and Ahmad (2014), Ahmad and Ali (2016), Audi and Ali (2016), Ali and Audi (2016), Ali and Audi (2018), Ali and Rehman (2015), Audi and Ali (2017), Ali and Naeem (2017), Audi and Ali (2017), Ali and Zulfiqar (2018), Ali et al., (2016), Arshad and Ali (2016), Ashraf and Ali (2018) Haider and Ali (2015), Sajid and Ali (2018), Ali and Senturk (2019), Kassem et al, (2019), Ali and Bibi (2020), Sulehri and Ali (2020) and Audi et al., (2021). So, it is suggested that the money demand function depends on household consumption, government consumption, consumer price index, remittances, population growth, and interest rate. Due to the use of socio-economic variables data the current study evaluates equation 7.

$$M2_t = E\,(HC_t, GC_t, CPI_t, RM_t, PG_t, I_t,) \quad (7)$$

Where

$M2_t$ = Broad Money (M2)
HC_t = Household consumption
GC_t = Government Consumption
CPI_t = Consumer Price Index
RM_t = Amount of Remittance
PG_t = Population growth
I_t = Interest Rate

The econometric model of this study become as:

$$LM2_t = \beta_0 + \beta_1 \mathrm{LHC}_t + \beta_2 LGC_t + \beta_3 LCPI_t + \beta_4 LRM_t + \beta_5 LPG_t + \beta_6 LI_t + \varepsilon_t \quad (8)$$

L represents the natural log, t is the period, β_0 is constant which has no economic value and ε_t is the white noise error term.

This study examines the socio-economic contributing factors of demand for money in Pakistan from 1980 to 2019. Money demand (M2) is taken as a dependent variable whereas, household consumption, government consumption, CPI, amount of remittances, population growth, and interest rate are taken as independent variables. The data of all the selected variables are taken from the WDI databases Various Issues of Economic Survey of Pakistan and official website of State Bank of Pakistan (SBP).

IV. Econometric Methodology

In this study, we use Augmented Dickey-fuller (ADF) and Phillips Perron (PP) unit root tests for removing the unit root problem in the data. Dickey and Fuller (1981) suggest the Augmented Dickey-Fuller (ADF) unit root test for time series data. The general form of ADF can be written as:

$$\Delta W_t = \gamma W_{t-1} + \sum_{z=1}^{w} \rho_z \Delta W_{t-z} + \omega_{1t} \quad (9)$$

$$\Delta W_t = \delta + \gamma W_{t-1} + \sum_{z=0}^{w} \rho_z \Delta W_{t-z} + \omega_{2t} \quad (10)$$

$$\Delta W_t = \delta + \alpha t + \gamma W_{t-1} + \sum_{z=1}^{w} \rho_z \Delta W_{t-z} + \omega_{3t} \quad (11)$$

Here $W_t$is a time series for testing unit roots, t is the time trend on $\omega_t$is the white noise error term. If Z=0 it is the case of the simple Dickey-Fuller (DF) test. The lagged dependent variables in the ADF regression equation are included until the error term becomes white noise. ADF uses the LM test for checking the serial correlation of error terms. The Null and Alternative Hypotheses of the ADF unit root test are:$\gamma = 0$ nonstationary time series, $\gamma < 0$ stationary time series, so, if we reject Null Hypotheses then our time series data is stationary.

Phillips and Perron (1988) present a unit root test, best known as the PP unit root test. The Null Hypotheses of PP and ADF have some normalized bias statistics and asymptotic distributions. PP has two main advantages over ADF. First, there is no need to specify the lag length of test regression. Second, it has strong power to predict serial correlation and heteroskedasticity. The simple equation of PP is as follow:

$$N_i = \delta + \gamma N_{h-1} + \varepsilon_h \quad (12)$$

So, null hypothesis is $\gamma = 0$ non stationary time series, and alternative hypothesis, $\gamma < 0$ Stationary time series. In econometric number of co-integration test are used for this purpose, such as Engle- Granger (1987) test, Maximum Likelihood-based on Johansen (1991/1992), and Johansen-Juselius (1990) tests. But this study uses Pesaran et al., (2001) most advanced Autoregressive Distributed Lag (ARDL) of co-integration. For ARDL following procedure can be used:

$$\begin{aligned} DLM2_t = {} & \beta_1 + \beta_2 t + \beta_3(LM2_{t-1}) + \beta_4(LHC_{t-1}) + \beta_5(LGC_{t-1}) + \beta_6(LCPI_{t-1}) + \beta_7(LRM_{t-1}) \\ & + \beta_8(LPG_{t-1}) + \beta_9(LPG_{t-1}) + ---- + \sum_{a=1}^{w} \beta_a D(LM2_{t-a}) + \sum_{h=0}^{w} \beta_h D(LHC_{t-h}) \\ & + \sum_{i=o}^{w} \beta_i D(LGC_{t-i}) + \sum_{t=1}^{w} \beta_t D(LCPI_{t-t}) + \sum_{k=1}^{w} \beta_k D(LRM_{t-k}) + \sum_{l=1}^{w} \beta_l D(LPG_{t-l}) \\ & + \sum_{m=1}^{w} \beta_m D(LI_{t-m}) + ---+ v_{jt} \end{aligned} \quad (13)$$

Based on this equation, the following null and alternative Hypotheses can be developed.

$H_0 : \beta_3 = \beta_4 = \beta_5 = \beta_6 = \beta_7 = \beta_8 = \beta_9 = 0$ (No co-integration among variables)

$H_A : \beta_3 \neq \beta_4 \neq \beta_5 \neq \beta_6 \neq \beta_7 \neq \beta_8 \neq \beta_9 \neq 0$ (Co-integration among variables)

If we reject the null hypothesis there is co-integration and vice versa. If long-run co-integration among variables is found Vector Error Correction Model (VECM) is used for short-run investigation. The VECM is explained as:

$$\begin{aligned} DLM2_t = {} & \beta_1 + \beta_2 t + \sum_{a=1}^{w} \beta_a D(LM2_{t-a}) + \sum_{h=0}^{w} \beta_h D(LHC_{t-h}) + \sum_{i=o}^{w} \beta_i D(LGC_{t-i}) + \sum_{t=1}^{w} \beta_t D(LCPI_{t-t}) \\ & + \sum_{k=1}^{w} \beta_k D(LRM_{t-k}) + \sum_{l=1}^{w} \beta_l D(LPG_{t-l}) + \sum_{m=1}^{w} \beta_m D(LI_{t-m}) + WECT_{t-1} \\ & + v_{jt} \end{aligned} \quad (14)$$

Here ECT is one time period lagged error correction term. The ECT gives the speed of regulation from the short run to the long run.

V. Results and Discussion

Table 1: Augmented Dickey-Fuller Test

	I(0)		I(1)	
Variables	t-Values	P-Value	t- Values	P-values*
LM	0.124212	0.9632	-4.719660	0.0006
LHC	0.413534	0.9807	-4.973708	0.0003
LGC	-0.814425	0.8026	-4.788601	0.0005
LCPI	0.071495	0.9587	-2.578129	0.0172
LRM	0.799025	0.9926	-4.078795	0.0032
LPG	-2.138752	0.2317	-1.923539	0.0078
LI	-3.083573	0.0374	-4.701763	0.0006

Table 2: Phillips-Perron Test

	I(0)		I(1)	
Variables	t-Values	P-Value	t- Values	P-values*
LM	0.094439	0.9608	-4.669602	0.0007
LHC	0.402541	0.9802	-4.945397	0.0003
LGC	-0.783980	0.8113	-4.822645	0.0004
LCPI	0.293641	0.9746	-2.787151	0.0707
LRM	0.512055	0.9848	-4.037804	0.0036
LPG	-0.991301	0.7456	-2.225956	0.0012
LI	-2.522939	0.0189	-4.630158	0.0007

Table 1 presents the results of the Augmented Dickey-Fuller (ADF) and Philips Perron (PP) unit root test. The estimated results of ADF show that only CPI is stationary at the level. In the estimated results of PP in table 3, only money demand is stationary at the level.

But the results of ADF and PP show that all selected variables are stationary at first difference. So, it is concluded there is a mixed order of integration among the selected variables of the model. Hence ARDL approach is more suitable for estimating the co-integration of money demand function in Pakistan (Kiptui, 2014 and Faridi and Akhtar, 2013). The estimated model has integration of order I(1,0,0,1,1,1,1) respectively. Microfit is used for finding the result of ARDL. A VAR lag range criterion is used for the lag order of the variables. Maximum 2 lags are allowed following LR, FPE, AIC, SC, and HQ criteria (Kjosevski 2013 and Halicioglu and Ugur 2005). The VAR lag criteria recommend that variables can be predicted through ARDL at the lag of order two. In table 3 each test especially AIC and SC test suggested that variables are estimated for long-run relation at 2 lags (Haider et al., 2013).

Table 3: Lag Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	125.8915	NA	2.16e-12	-6.993619	-6.679369	-6.886451
1	443.5300	485.8000	3.16e-19	-22.79588	-20.28188	-21.93853
2	536.1052	103.4664*	3.61e-20*	-25.3593*	-20.64537*	-23.75160*

*specifies lag nominated by the conditions
LR sequential modified LR test statistics (each at 5 percent level)
FPE mean Final Indicator Error
AIC present Akaike Information Criteria
SC is Schwarz Information Criteria
HQ is Hannan Quinn Information Criteria

Table 4: ARDL statistics for (LM_2)

Explained Variable	ARDL(1, 0, 0, 1, 1, 1, 1)
LM2	**F-Statistics**
	4.895519

Critical value	**Lower Bound**	**Upper Bound**
95%	2.45	3.61

90%	2.12	3.23

Table 5*: Long Run Measurements*

Dependent Variable: LM2

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LHC	0.297430	0.138399	2.149082	0.0424
LGC	1.482688	0.229410	6.463035	0.0000
LCPI	0.214883	0.172085	1.948702	0.0243
LRM	0.142880	0.057046	2.504630	0.0198
LPG	-1.233118	0.504825	-2.442664	0.0227
LI	0.081198	0.058415	1.390019	0.1778
C	-25.060523	6.039693	-4.149304	0.0004

F statistic is used for examining the co-integration between the selected variables of the model. The outcomes of F statistics are presented in table 4. F statistics value 4.895 is higher from upper bound 3.61 and 3.23 at 95 and 90 percent level of significance respectively (Ngoc-Anh Lai and Khan and Hye 2011). Hence null hypothesis is rejected mean so there is co-integration between the determining factors of the model. Thus, it is suggested that broad money (LM_2), household consumption(lHC_{t_t}), government consumption($lGC_{\ t}$), the consumer price index($lCPI_t$), amount of remittance(lRM_t), population growth(lPG_t) and Interest Rate (LI_t) have a long-run relationship over the selected period.

Table 5 presents the long-run results of the demand for money and its contributing factor in the case of Pakistan. The results show 1percent increase in household consumption increase money demand by 0.297 percent. The change in government expenditure will also affect the money demand by 1.482 percent (Apere and Karimo 2014). The income of people increases then they prefer to luxuries and demand for more money. So, the coefficients of household and government consumption have a positive and significant impact on the demand for money in the case of Pakistan. Remittances are a major source of capital inflows for Pakistan in recent years. The long-run ARDL analyses show that remittances have a positive connection with the demand for money in Pakistan. The results express 1 percent increase in remittances brings a 0.143 percent increase in demand for money in Pakistan. These results show that there is an optimistic correlation between remittances, economic progress, and money demand. As remittances increase people below the poverty line moves upward on the poverty line. With an increase in remittances, their income level also increases and people move further away from the poverty line and also demand more money. This impact of remittances is statistically significant in the selected model of money demand in Pakistan. Remittances help improve living standards by increasing money demand (Sliva et al., 2009 and Owaif 2008). Remittances have a significant effect on economic development such as reduction in unemployment, greater foreign exchange income, increase in savings, and ultimately increase in investment all this increases money demand in long run. 1 percent increase in population growth is associated with a 1.233 percent decrease in money demand in Pakistan. Because when the income of people increases then they want to save more money for precautionary and speculative purposes. The consumer price index and interest rate have no significant influence on money (M_2) demand in Pakistan (Chudhary et al., 2012, Dube, 2013 and Simawn 2014). CPI coefficient value is positive mean inflation or high price level increase money demand in Pakistan (Azim et al., 2010).

Table 6: **Short Run Measurements**

Dependent Variable: LM2

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LHC)	0.228481	0.121119	1.886424	0.0719
D(LGC)	1.138979	0.239493	4.755799	0.0001
D(LCPI)	-0.299031	0.282170	-1.059753	0.3003
D(LRM)	0.034601	0.042869	1.807137	0.0979
D(LPG)	0.818333	0.929391	0.880504	0.3877
D(LI)	-0.028174	0.039729	-1.709159	0.0854
ECT(-1)	-0.768185	0.132012	-5.819048	0.0000

The short-run results are presented in Table 6. Short-run results show that a 1 percent increase in government consumption in the short-run brings a 1.139 percent rise in demand for money in Pakistan. Both in the short and long run, government consumption affects money demand more than as compared to other determinants in Pakistan. Household consumption, amount of remittances, and interest rate show the positive and insignificant effect on demand for money in Pakistan during the short-run (Malumisa 2015, Kamau 2012). Nasir and Naheed (1983), Kjosevski (2013), Iyoboyi and Pedro (2013), and Munawar and Iqbal (2015) focus that interest rate has a significant role in the solidity of money demand. In the short run, only LHC is significant. The value of ECT (-1) is very statistically (Sarwar et al., 2013). ECT (-1) coefficient explains 76 percent variation from last year is correct next year. The significant value of error correction tells the speed of adjustment from short run to long run. Error correction term approved that variables converge to long run.

Table 7: Model Correction Test (Ramsey RESET)

	value	P-value
t-statistic	0.993619	0.886451
F-statistic	-22.79588	-21.93853
Likelihood ratio	-25.3593*	-23.75160*

Table 7 presents the results of Ramsey RESET of model specification. The results show that our model is good and correctly specifies because the p-value is insignificant. If F-statistics is highly significant then we accept the null hypothesis and the model is miss-specified. This shows that the selected determinants of money demand in Pakistan are correctly specified.

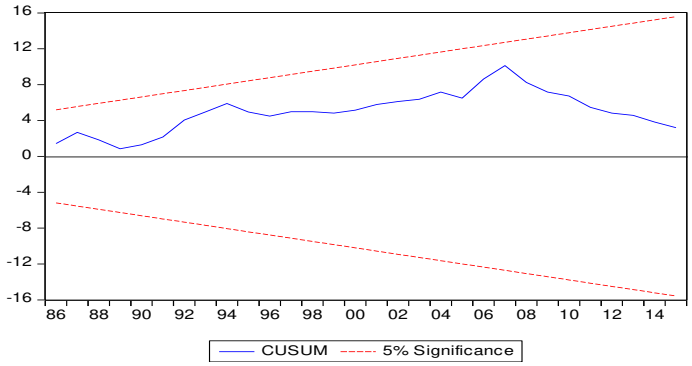

Figure 1: Stability test (CUMSUM) M2

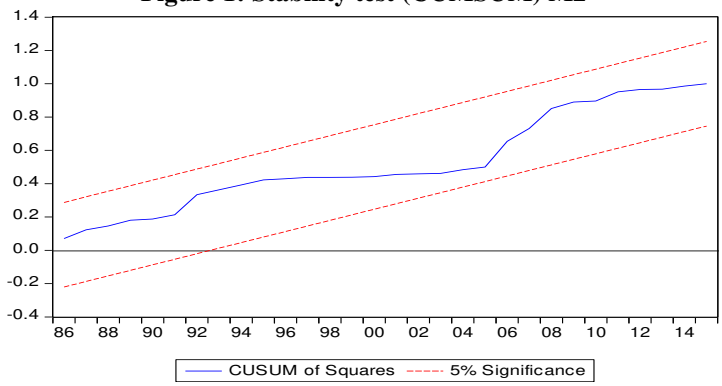

Figure 2: Stability test (CUMSUM-Sq) M2

The cumulative sum of recursive residuals and CUMSUM square show the consistency of the model (Sulman and Dafaalla 2011 and Bashierr and Dahlan 2011). The graphical representation is significant at 5 percent level this means money demand (M_2The) the function is stable from 1980 to 2019 in Pakistan. CUSUM is significant and does not cross to the critical line that is shown by flatline then further clarified by CUSUMQ.

VI. Conclusions

In this study, we analyzed the money demand function and its socio-economic in Pakistan by using annual time series data for 1980-2019. The data is collected from WDI databases maintained by World Bank. ADF and PP unit root tests are used for checking the stationarity of the variables. ARDL bounds testing approach is used for examining the co-integration between the selected variables of the model. Granger Causality test is used for examining the causal relationship of variables. The long-run results of the study show that government consumption, household expenditure, and amount of remittances have a positive and significant relationship with money demand in Pakistan. The long-run results show that CPI has a positive and significant relationship with money demand in Pakistan. Population growth has a negative and significant relationship with the demand for money. The interest rate has a positive but significant association with money demand in Pakistan. In the short-run results show that household consumption, government consumption, and amount of remittances have positive and significant relation with money demand. CPI and population growth have an insignificant short-run relationship with money demand in Pakistan. The interest rate has a short-run negative and significant relationship with money demand. Based on empirical results and discussion here are some policy recommendations for Pakistan. There is a positive and insignificant relationship between household consumption and (M_2). So, the State Bank of Pakistan can increase the money supply for fulfilling the increased money demand of households. So, there is a need for easy monetary policy by the State Bank of Pakistan. Government expenditures have also a direct relationship with (M_2), so SBP's easy monetary policy will help to meet the increasing demand by the government expenditure. The inflation coefficient is either positive or negative. When it is positive, the value of money decreases due to the high inflation rate then people demand more money to purchase their necessities. The inflation coefficient is negative when people do not demand money instead of the higher rate of inflation. The inflation rate is also consistently increasing for the last 10-15 years because of food prices hike. As the major portion of income is used for basic food items (household consumption) thus the poor part of the population is badly affected by inflation. The primary objective of monetary policies is stability in the price level (CPI) with the help of the central bank because all monetary policies are controlled by the state bank. The Central bank tried to control inflation by the easy monetary policy for achieving growth. But inflation converts into double-digit in 2005 due to expansionary monetary policy that cannot support growth. Many authors shed light on the inflation and money demand relationship e.g. Khan and Sajjid (2005), Qayyum (2005), and Hussain et al., (2006). This study is supported too fruitfully with the help of household and government consumption, consumer price index, remittances, population growth, and interest rate for making stable economic (monetary and fiscal) policies. Additionally, consumption, interest rate, and CPI depict a clear portrait of the financial sector in Pakistan (Sarwar, et al., 2010). So socioeconomic factors play an important role in determining money demand in Pakistan.

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