How Government Policy and Demographics affect Money Demand Function in Bangladesh?

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Abstract. Money demand has a key position in macroeconomics generally and monetary economics particularly. The improved economic condition of any country is a sign of increasing money demand and deteriorating economic climate is a sign of decreasing money demand (Maravic and Palic, 2005). In this study, Autoregressive distributed lag (ARDL) approach of co-integration developed by Pesaran et al., (2001) is used to estimate the money demand function. Real interest rate, GDP per capita, exchange rate, fiscal deficit, urban and rural population are selected to determine money demand function in Bangladesh over the period from 1975-2013. The co-integration analysis reveals that interest rate and per capita GDP exerts significant effect upon money demand both in long run and short run as well. Both urban and rural population have significant effect on money demand in the long run and short run and money demand function is found stable over time.

Keywords. Bangladesh, Money demand, Per Capita GDP, Real interest rate, Exchange rate, Fiscal deficit, Urban and Rural Population

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1. Introduction

One of the most crucial problems, of developing and developed countries, is a problem of estimation of money demand function. Why stability is considered an important for money demand function? An extensive volume of research has been done by the researchers to estimate money demand function and its stability. Due to difference in methodologies, the results had been mixed and researchers could not reach at the same conclusion. The other reason of dissimilar results is different data time spans. The earliest theory presented by Fisher (1911) is quantity theory of money labeled as transaction demand for money. He ignored interest rate and focused on only income in his theory as a main determinant of money demand.

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The money demand is inelastic to interest rate changes. The general form of this theory can be stated as,

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

Marshall (1923) and Pigou (1917) did work on Cambridge cash balance approach of money demand. This theory also represents the connection between total production of goods, total amount of money, the price level and how money moves in any economy. Cambridge approach focuses on individuals' income which they want to hold. The individuals do not suffer from institutional limitations i.e. the use of credit cards by individuals.

Keynes (1936) introduced three motives of money demand in his famous book "The General Theory of Employment, Interest and Money". Those motives are used as, transactional, precautionary and speculative purposes. Keynes theory (1936) is generally known as *liquidity preference theory*. In opposite to Fisher, Keynes introduced another variable affecting money demand i.e. interest rate.

Portfolio theories emphasized that the prime function of money is store of value. Friedman (1956) and Tobin (1958) introduced the portfolio theories to determine demand for money. They argued that the money which people hold is necessarily a part of their portfolio assets. Compared with other assets, money proposes various combinations of risks and returns.

We incorporate variables like fiscal deficit, exchange rate and population in addition to income and interest rate in our model to determine money demand function in the long run. For analysis, this study employs time series data for the period ranges from 1975 to 2013.

1.1 Significance of the study

The most disputed issue is the demand for money and its empirical analysis in developing economies. The literature available on this subject is rich and robust. The monetary policy cannot work properly without stable money demand function.

The interest rate increases when the international economies crash or any domestic economy deals with depression/recession. This situation raises some questions, such as "what is the function of monetary policy? What is the reason of economic boom and recession? Can money be used as a tool to boost growth empirically in developing countries? The above questions require proper functioning of monetary policy and particularly the money demand function. The quantity of money demand decides that how much this quantity can be used to stimulate economic growth in developing countries. Monetary policy works efficiently with stable money demand function. The steady-state relationship between money demand and its determinants determines the success of the policy (Baharumshah, et al. 2009).

1.2 Theoretical Foundation of the Study

The previous studies concluded the relationship between demand for money and its determining factors in long run. Some literature is discussed here.

Siddiki (2000) made analysis of money demand for Bangladesh by employing ARDL Bound Testing approach during 1975-1995. The variables like, income, interest rate, unofficial exchange rate were employed to determine money demand function for analysis. The results support the presence of co-integration among variables. The findings revealed that all independent variables influence demand for money in long run. Ahmed (2007) examined the function of money demand using Engle-Granger test for Bangladesh over the period ranges from 1980-2006. The results explored that interest rate; inflation rate and income have an effect on demand for money in long run. Interest rate and inflation affects negatively while income responds positively to money demand in the long run.

Miah (2011) estimated narrow and broad functions of money demand for Bangladesh using quarterly data from 1999 to 2005. The empirical results showed that there exists stable connection between monetary aggregates (M1, M2 and M3) and income, interest rate, exchange rate. The variables are co-integrated with MI and M2 but it is not so with M3. No stability is found for all monetary aggregates, used in this study. Alkiswani (2001) empirically investigated the function of narrow money demand using the quarterly data for Syria over the period 1974-1994. The Error Correction Modeling and Co-integration approach were adopted to estimate the short run and long run relationship respectively. Positive correlation was found between real income and money aggregate (M1), while the coefficient of inflation was negative. The exchange rate and interest rate did not respond to money demand. Nwaobi (2002) employed Johansen and Jusilius maximum likelihood approach of co-integration to observe long run link among demand for money, rate of interest, price level and real income in Nigeria for the period ranges from 1960 to 1995. The stable money demand function is observed both in long run and short run and income is proved most suitable scale variable in determining money demand function. Economidou and Bahmani-Oskooee (2005) investigated the function of money demand for Greece using quarterly data during 1975-2002. The findings showed the existence of co-integration between money demand and its determining factors. Positive correlation was found between real income and money aggregates while the coefficient sign of interest rate was negative. However, the M1 monetary aggregate remained stable rather than M2 in Greece.

Khrawish et al. (2012) examined the link between budget deficit and money demand using co-integration and vector error correction modeling techniques during 1992 to 2010. The variables like real GDP, consumer price index, real government expenditures and interest rate (IR) were used to determine money demand function. The findings revealed significant and positive long run relationship between real money demand and real GDP, budget deficits, Internal Debt and external debt. And negative long run link was found between money demand and consumer price index, real government expenditure and deposit rate (IR).

Tang (2007) estimated the factors affecting money demand for ASEAN-5 economies i.e. Thailand, Malaysia, Singapore, the Philippines, and Indonesia during 1960-2005. The co-integration was found between real money balances and exchange rate, inflation, real income in Malaysia, the Philippines and Singapore. The remaining two countries showed no co-integration. In short run, money demand function remained stable in all countries.

Valadkhani (2008) examined the money demand function for Asian-pacific region of six countries i.e. China, Japan, Malaysia, the Philippines, Singapore and Fiji. The purpose of this study was to explore factors of money demand for both short and long run namely real income, rate of inflation, interest rate and real effective exchange rate using panel data from 1975-2002. Co-integration was observed between demand for money and its determining factors after applying Engle-Granger technique. The ECM test revealed that in short run, only income, inflation and interest rate effects money demand (M2) significantly.

Money demand function is determined by the various macroeconomic factors. These factors can be interest rate, exchange rate, fiscal deficit, financial innovation, inflation, real income, external and internal debt, tax revenue, Investment, energy crises, oil shocks etc. The relationship among these variables has been of vital concentration for the researchers. The purpose of these researches is to examine the faction, importance and effect of these variables on money demand and its stability. In 1963, Nobel Laureate, Robert Mundell (1963) argued that exchange rate could work in determining the money demand function. He anticipated the idea that along with income and interest rate, exchange rate could become a major determinant of money demand.

At present the researchers are much concerned to sort out the relationship between fiscal deficit and money demand. The Keynesian proposition and Ricardian equivalence hypothesis provide a base to observe the link between money demand and fiscal deficit. These two approaches can be tested empirically. We incorporate fiscal deficit in our model in addition to income, interest rate and exchange rate. Population growth also affects money demand function (Faridi and Akhtar, 2013). In this thesis we incorporate urban and rural population in our model as independent variables to get some unique and interesting results using ARDL approach.

In this study we employ exchange rate, fiscal deficit, urban and rural population along with interest rate, real income as independent variables to determine the money demand function for Bangladesh. We have applied ARDL approach to examine long run and short run results simultaneously. We investigate the function of money demand and its stability empirically for Bangladesh. This would be a new addition in the previous literature of money demand function.

2. Method and Procedure of the Study

2.1. Model Specification

The functional relationship of variables is given under.

$$LMON_t = f(LFISCDEF_t, LGDPPC_t, LEXCR_t, LINT_t, LURB_t, LRUR_t)$$

Whereas,

LMON= log (Money demand (as a percentage of GDP))
LEXCR= log (Official exchange rate (LCU per US$))
LGDPPC= log (Per Capita GDP)
INT= Real Interest rate
LFISCDEF= log (Fiscal deficit (as a percentage of GDP))
LURB = log (Urban population as (% of total population))
LRUR = log (Rural Population as (% of total population))

2.2 Data Source

The time series data on fiscal deficit, official exchange rate, GDP per capita, urban population, rural population, real interest rate and money demand (M2) is obtained from Word Development Indicators (2015). The data duration is from 1975-2013 for Bangladesh.

2.3 Estimation Techniques

2.3.1 Ng-Perron for Unit Root Problem

Ng and Perron (2001) build four kinds of tests, based on GLS de-trended method of ERS. They used this method in order to develop proficient version of updated version of Phillip Perron test. It is relatively easy to apply and preferred alternative to the traditional ADF and PP tests. This test gives more robust results. The other proficiency of this test is having high power than Phillip Perron test, when the value of φ moves towards one.

2.3.2 Estimating Co-integration using Autoregressive Distributed Lag Model (ARDL)

The Autoregressive Distibuted Lag (ARDL) model was extended by Pesaran et al. (2001). This approach usually deals with single Co-integration. In Johnson approach, all variables are co-integrated at I(1). In ARDL approach it is not so. This approach is applicable when we have I(0) and I(1) in our set. However to avoid the spurious relation between money demand (M2) and its determining factors, the researcher analyst considered Autoregressive Distibuted Lag (ARDL) co-integration approach for reliable results in short run and long run equilibrium.

A general form of all variables with relation to money demand is given as below:

$$\Delta LMON_t = \alpha_{10} + \alpha_{11} LMON_{t-1} + \alpha_{12} LINT_{t-1} + \alpha_{13} LEXCR_{t-1} + \alpha_{14} LFISCDEF_{t-1} + \alpha_{15} LGDPPC_{t-1} +$$
$$\alpha_{16} LRUR_{t-1} + \alpha_{17} LURB_{t-1} + \beta_{11} \sum_{i=1}^{p} \Delta LMON_{t-i} + \beta_{12} \sum_{i=0}^{p} \Delta LINT_{t-1} + \beta_{13} \sum_{i=0}^{p} \Delta LEXCR_{t-i} +$$
$$\beta_{14} \sum_{i=0}^{p} \Delta FISCDEF_{t-i} + \beta_{15} \sum_{i=0}^{p} \Delta GDPPC_{t-i} + \beta_{16} \sum_{i=0}^{p} \Delta LRUR_{t-i} + \beta_{17} \sum_{i=0}^{p} \Delta LURB_{t-i} + \eta_1$$

The modified equation for short run is given as below:

$$\Delta LMON_t = \beta_{10} + \beta_{11} \sum_{i=1}^{p} \Delta LMON + \beta_{12} \sum_{i=0}^{p} \Delta LFISCDEF_{t-i} + \beta_{13} \sum_{i=0}^{p} \Delta LINT_{t-i} + \beta_{14} \sum_{i=0}^{p} \Delta LGDPPC_{t-i} +$$
$$\beta_{15} \sum_{i=0}^{p} \Delta LRUR_{t-i} + \beta_{16} \sum_{i=0}^{p} \Delta LURB_{t-i} + \beta_{17} \sum_{i=0}^{p} \Delta LEXCR_{t-i} + \gamma_{11} ECM_{t-1} + \varepsilon_1$$

ARDL bound testing approach by Pesaran et al. (2001) is used for attaining robust results and reliable estimates of the long run coefficients in case of small sample. The short run estimates are also observed. We have three situations here

i. All of the series are I (0), and hence stationary, here we simply use the OLS technique because our data is stationary at level.
ii. All of the series are integrated at first difference e.g. I(1) but they are not co-integrated then we estimate standard regression model with OLS.
iii. All of the series are integrated of the same order and they are also co-integrated, here we use two types of model. First OLS regression model to observe the long run relationship among variables and second error correction model (ECM) to investigate the short run dynamics.

What do we do in such situation if we want to extract both long and short run relationship using one statistical technique? This is where the ARDL model enters the picture. That's why we prefer to use this approach to avoid autocorrelation and endogenity problems.Therefore in this study we use ARDL bound testing approach instead of panel data approach.

3. Data Analysis and Interpretations

The results of descriptive statistics have been shown in table 1. The estimated values of Kurtosis and Skewness indicate the normality of data. The Jarque- Bera is usually employed to observe the normality of data and insignificant values of Jarque- Bera test exposed that data series is normally distributed except fiscal deficit and real interest rate. After checking the normality, the unit root test is applied to expose the problem of unit root in data series.

Table 1. *Descriptive Statistics*

Series	LMON	LRUR	LGDPPC	LFISCDEF	LEXCR	INT	LURB
Mean	3.366727	4368.657	95.91936	-0.343780	3.628831	0.820744	300.3923
Std. Dev.	0.588295	66.13940	2.965540	0.196631	0.552477	0.844594	28.01038
Jarque-Bera	1.691555	1.541997	4.604044	19.80064	2.511359	41.12441	4.289128

Probability	0.429223	0.462551	0.100056	0.000050	0.284882	0.000000	0.117119

Th Ng-Perron technique is used here to check the stationary in data series. The estimates are shown in table 2. The results declare that at level specification per capita GDP, rural population, exchange rate and fiscal deficit are witnessed as stationary but money demand, interest rate and urban population are witnessed as non-stationary variables. However, all variables at first difference specification are observed as stationary. The results are shown below

Table 2. Ng-Perron Unit Root Test

Ng-Perron Test Statistics				
Variable	At Level			
	MZa	MZt	MSB	MPT
LMON	1.40835	1.61924	1.14974	96.9891
LGDPPC	-14.9658	-2.47504	0.16538	2.57712
LFISCDEF	-18.1398	-2.93544	0.16182	1.62387
L EXCR	-7.36609	-1.71951	0.23344	4.01518
INT	-3.32431	-1.19864	0.36057	7.29544
LURB	1.13115	1.50281	1.32856	120.545
LRUR	-7.76968	-1.74571	0.22468	3.93803
Variable	At First Difference			
	MZa	MZt	MSB	MPT
ΔLMON	-8.45356	-1.98065	0.23430	3.17979
ΔLGDPPC	-11.0863	-2.31432	0.20875	2.36539
ΔLFISCDEF	-15.1034	-2.74629	0.18183	1.62876
ΔLEXCR	-7.64355	-1.93279	0.25287	3.28664
ΔINT	-18.1074	-3.00771	0.16610	1.35748
ΔLURB	-24.1054	-3.39522	0.14085	1.26906
ΔLRUR	-17.3173	-2.52403	0.14575	2.83452
Asymptotic Critical Values				
Level of Significance	1 Percent	-13.8000		
	5 Percent	-8.10000		
	10 Percent	-5.70000		

After checking the stationary and non- stationary in all variables, the mixed order of integration [I (0) and I (1)] has been found in this study. Therefore we have applied ARDL test to find the long run relationship between money demand and its determinants. The empirical findings indicate that the calculated value is more than its upper critical bound. It denotes the stable relationship between dependent and independent variables in the long run. Moreover, the diagnostics designate that the issues of heteroscedasticity and serial correlation do not exist in data series. The results are shown in table 3.

Table 3 *Autoregressive Distributed Lag Estimates*

Dependent variable is LMON
Estimated Model: LMONt= f (LGDPPCt, LFISCDEFt, INTt, LEXCRt, LRURt, LURBt)

F-statistic	95% Lower Bound	95% Upper Bound	90% Lower Bound	90% Upper Bound
8.4000	2.8234	4.2227	2.3669	3.6219
W-statistic	95% Lower Bound	95% Upper Bound	90% Lower Bound	90% Upper Bound
58.7999	19.7639	29.5586	16.5682	25.3532

Diagnostic Tests

R-Bar-Squared	0 .99202	Serial Correlation	0.2011E-4 [0.996]
F-Stat. F(8,29)	576.1972[0.000]	Functional Form	0.73693 [0.391]
Akaike Info. Criterion	56.1102	Normality	2.9338 [0.231]
Schwarz Bayesian Criterion	48.7411	Heteroscedasticity	0 .63063 [0.427]

The long run coefficients are reported in table 4 which illustrates the long run results. The estimated results disclose that interest rate effects money demand significantly while the sign of coefficient is positive. These above findings are consistent with Narayan et al. (2009) and Abdulkheir (2013). The findings disclose one percent increase in interest rate tends to increase in money demand by 0.64 percent.

Table 4: *Estimated Long Run Coefficients using ARDL Approach*

Dependent variable is LMON

Variables	Coefficient	Standard Errors	T-Ratio	Prob. Value
LGDPPC	0.97807	0.48018	2.0369	0.051
INT	0.64487	0.32009	2.0147	0.053
LFISCDEF	-0.27053	0.22816	-1.1857	0.245
LEXCR	-0.21293	0.66368	-0.32083	0.751
LRUR	0.12794	0.067364	1.8992	0.068
LURB	0.23502	0.12116	1.9398	0.062
C	-719.6912	375.6314	-1.9160	0.065

Moreover; the coefficient of real GDP has found to be high and significant contributor to money demand in Bangladesh and it reveals that money demand increase by 0.98 percent by one percent increase in real income in the long run. Ahmed (2007) found the same results for income. Both interest rate and real income were found significant contributor to money demand function. Fiscal deficit has negative and insignificant effect on money demand. It reveals that one percent increase in budget deficit tends to decrease money demand by 0.28 percent in long run. Al-Qudair and Al-Towaijri, (2003) witnessed negative effect of fiscal deficit on money demand function. Exchange rate also exerts negative effect upon money demand. One percent increase in exchange rate tends to decrease in money demand by 0.21 percent. Arize and Nam (2012) concluded the similar results. While positive and significant link was found between rural and urban population and money demand. Faridi and Akhtar (2013) captured the impact of population growth on money demand function in their study.

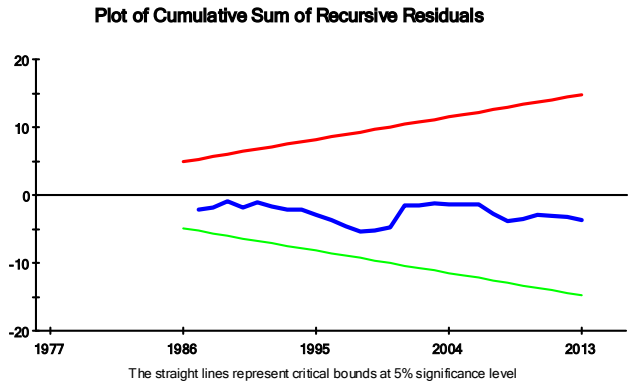
After discussing the results of long run coefficients we would move to find the short run coefficients using error correction representation. The results of short run coefficients are shared in below table 5.

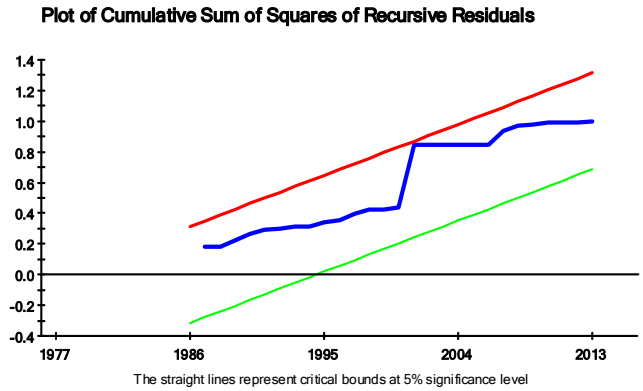
Table 5. *Error Correction Representations for the selected ARDL Model*

Dependent variable is dLMON				
Variables	**Coefficients**	**Standard Errors**	**T-Ratio**	**Prob. Value**
ΔLGDPPC	0.27265	0.085179	3.2008	0.003
ΔINT	0.095379	0.029584	3.2240	0.003
ΔLFISCDEF	-0.075412	0.058186	-1.2960	0.205
ΔLEXCR	-0.059356	0.17900	-0.33159	0.743
ΔLRUR	0.035664	0.011908	2.9950	0.005
ΔLURB	0.065514	0.021945	2.9854	0.006
ecm(t-1)	-0.27876	0.10946	-2.5467	0.016

R-Squared	0 .69594	R-Bar-Squared	0.61206
S.E. of Regression	0.04992	F-Stat. F(7,30)	9.4821[0.000]
Mean of Dependent Variable	0.056212	S.D. of Dependent Variable	0.080157
Residual Sum of Squares	0.072285	Equation Log-likelihood	65.1102
Akaike Info. Criterion	56.1102	Schwarz Bayesian Criterion	48.7411
DW-statistic	1.9956		

The estimated results disclosed that interest rate effects demand for money significantly while due to interest rate volatility, the coefficient sign remains positive. Positive and significant link is found between them. Both fiscal deficit and exchange rate effects money demand negatively and insignificantly in short run. GDP per capita responds positively and significantly to money demand. While positive and significant relationship was found between rural population and money demand. Urban population effects money demand positively and significantly. After estimating the short run dynamics, the stability of money demand function is tested during the period 1975 to 2013. The findings exposed stability in data series for Bangladesh. The graphical representation makes it clear. The money demand function (M2) remains stable over time.





4. Conclusion and Policy Recommendations

The prime objective of this study is to examine the factors influencing money demand function for Bangladesh. The estimation process starts from analyzing unit root test, for instance: Ng-Perron unit root test and KPSS unit root test. These two tests are often employed to observe the small sample size. They give superior estimations and more reliable tests. When we become certain for the existence of stationary in variables at level or at first difference, then it is crucial to apply ARDL bound testing approach to explore the co-integration among all variables used for three countries.

This study selects money demand (M2) as dependent variable and interest rate, real income, exchange rate, fiscal deficit, urban and rural population as independent variables.

The data is being used of thirty nine years ranginf from 1975 to 2013. The co-integration analysis reveals that all variables except fiscal deficit and exchange rate are co-integrated in Bangladesh analysis. The interest rate and real income affects money demand significantly. The urban and rural population influence money demand positively and significantly. In case of short run, interest rate, real income, urban and rural population has significant effect on money demand while fiscal deficit and exchange rate are found to be insignificant. By incorporating CUSUM and CUSUMSQ tests, we check the stability of money demand. We found the stable function of money demand.

We draw some policy implications here which would facilitate policy advisors to work.Our findings reveal the significance of monetary targeting (M2) and it is a better option for Central

Bank of Bangladesh to use (M2) in the execution of monetary policy. In our analysis, we find a stable money demand function.

In our model, we added some new variables apart from conventional variables like real income, nominal interest rate. The addition of some new variables gives robust and reliable estimates after analysis. We incorporate exchange rate, fiscal deficit, rural and urban population in our model to get some unique results. Second policy makers can better understand the main determinants of money demand. They are also able to understand three things: whether depreciation leads to currency substitution or not; whether any change in interest rate influence money demand or not; whether change in fiscal deficit make any change in money demand.

The stable money demand function is necessary for proper performance of monetary policy in case of Bangladesh. If it happens, then the economy will grow to promote business and economic activities in Bangladesh.

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