International Review of Business Research Papers
Vol. 16. No. 1. , March 2020 Issue, Pp.34– 54

Financial Innovations and its Impact on Money Demand in Bangladesh: An Error Correction Model (ECM) Approach

Mainul Islam Chowdhury and Sunny Rabiul Karim

Rapid innovations in the financial sector is changing the characteristics of different macroeconomic variables like the money demand function. There has been several studies to investigate the determinants of money demand in Bangladesh but none has emphasized on the impact of financial innovation on the money demand function. The main focus of this paper is to fill that gap by answering the following question "Does financial innovations have a significant impact on the demand for money?" The paper employs the Auto Regressive Distributed Lag (ARDL) Model and the Error Correction Model (ECM) to investigate the long-term and short-term impact of financial innovations on the money demand function in Bangladesh. Determining a money demand function is crucial for the effectiveness of monetary policy. This study finds a strong and significant positive relationship between money demand and financial innovations in Bangladesh. Money demand also responds positively to the industrial production index (a proxy for economic activity). Inflation, on the other hand, has a strong and significant negative relationship with money demand. Interest rate and exchange rate does not seem to have a significant impact on money demand in Bangladesh.

Keywords: money demand function, Auto Regressive Distributed Lag, Error Correction Model

1. Introduction

The Central Bank of Bangladesh, Bangladesh Bank (BB), with consultation of the Ministry of Finance (MoF) conducts monetary policy in Bangladesh, mostly by monetary targeting (Monnin and Barkawi, 2015). The main instrument used is credit control (Hossain, 1993). BB initially calculates the projected growth rate of broad money by taking into account growth rate of real output, rate of monetization of the subsistence sector and the rate of inflation (Rahim and Sohrabuddin, 1988). BB then tries to keep the actual money supply growth as close to the projected rate through monetary policy as possible.

The success of monetary targeting depends on three conditions (Monnin and Barkawi, 2015). Firstly, it is essential to establish a stable money demand function in Bangladesh in order to undertake proper monetary targeting. Secondly, a strong and reliable relationship must exist between objectives, such as output growth and inflation, and intermediate targets. Thirdly, BB must be capable of steering the intermediate target

Dr. Mainul Islam Chowdhury, Assistant Professor, Department of Economics, School of Business and Economics, North South University, Dhaka 1229, Bangladesh, Email: mainul.chowdhury@northsouth.edu

Sunny Rabiul Karim, Department of Economics, University of Ottawa, Canada

variables like broad money through operational target variables (e.g. reserve money) it can influence directly. None of these conditions have been fully realized in Bangladesh. The aim of this paper is to understand the nature of the money demand function, so that successful monetary targeting can be conducted in Bangladesh.

The research question addressed in this study is "Does financial innovations have a significant impact on the demand for money?" Therefore, the objective of this paper is to incorporate financial innovations in the classical demand for money function in order to investigate the significance of financial innovations. If financial innovations have a significant impact on money demand, and monetary targeting is carried out without taking the impact into account, it can cause distortions from the actual objectives of the Central Bank. Therefore, checking for a stable money demand function by taking into account the impact of financial innovations is necessary for accurate projections of the growth rate of money demand. That is exactly what we will try to explore through this study as incorporating financial innovations in the money demand function in the context of Bangladesh have not been carried out before.

Bangladesh has undergone a number of financial reforms in three major areas. Firstly,BB has given licenses to a number of private and international banks to operate in Bangladesh in order to create a competitive banking system (Hossain, 2000). Secondly, controls over interest rates, exchange rates and capital flows have been relaxed. A managed floating exchange rate was adopted in 2000s. Thirdly, measures have been taken to develop money and capital markets. These reforms have caused a massive increase in the rate of financial development and financial innovations, based on several indicators such as bank branches per 100,000, number of ATMs per 100,000 and private credit by deposit money banks to GDP (World Development Indicators of the World Bank).

For our analysis, we have used "depository institutions' credit to private sector" as a proxy for financial innovations. The appropriate methodology chosen for our analysis is the Error Correction Model (ECM) approach, which is an addition to the Autoregressive Distributed Lag (ARDL) approach. This methodology was deemed appropriate as we have a mixture of I(0) and I(1) variables in our dataset based on unit root testing. We started our analysis with unit root testing using the Akaike Information Criterion (AIC) in order to find the order of integration of variables. This is followed by ARDL bounds test to test for cointegration amongst variables. We then estimate the long-term coefficients using the ARDL approach, and the associated short-term coefficients using the ECM approach.

The paper is organized as follows. Section 2 is comprised of the review of relevant literature. This section is divided into two parts. The first part establishes a theoretical framework from which our model is derived from. The second part historically lists the empirical studies done on the money demand function in the context of Bangladesh, and studies which have incorporated financial innovations in the money demand function for other countries. We have looked at the studies which incorporated financial innovations in money demand for other countries, as such studies have not been conducted for Bangladesh. Most of the countries which we have looked at are developing countries, with similar profiles to that of Bangladesh. Section 3 explores the methodology used in this study. It lists the variables which we have incorporated into our model and their sources, followed by the expected results from our study and a detailed rationale into why we have chosen the specified methodology. It also presents the results of the unit root test, based on which our model was specified. Section 4 presents the results of our study. It presents the results of the ARDL bounds test, the ARDL model and the ECM. It also presents the results of stability tests. Section 5 states the conclusions and then section 6 provides details about limitations and areas of further research that can be carried out in the future.

2. Literature Review

2.1 Theoretical Framework

Before addressing our research question, we shall look in to how theories of money demand have evolved over time. The first attempts to develop a quantity theory was done during the Renaissance era. In its simplest form, the general price level is directly proportional to the money supply. This is based on two assumptions. The first assumption is that prices and wages are perfectly flexible. Therefore, the economy is at full employment level in the long run. The second assumption is that “supply creates its own demand,” otherwise known as the Say’s Law of Market (Patinkin, 1972).

Fisher (1911) emphasized on money as a medium of exchange (money is demanded for transaction purposes) and developed the equation of exchange:

$$MV = PT$$

Where, M is the total stock of money in the economy, V is the velocity of circulation, P is the price level of individual goods in the economy and T is the volume of goods transacted. Assuming that V and T are constant in the economy at a certain period of time, we can see that an increase in the stock of money in the economy will cause an increase in the general price levels.

An alternative version of the quantity theory was developed by neoclassical economists like Pigou (1917) and Marshall (1923). This was called the Cambridge approach or cash back approach (Sriram, 1999). They argued that money was used both as a medium of exchange and a store of wealth which is determined primarily by individual preferences. Therefore, people hold money for transaction purposes and to provide security against any unforeseen negative shocks. Their theory can be summarized by the following equation:

$$Md = kPY,$$

where, Md is the demand for money, k is the proportion of national income people want to hold, Y is national income or output, and P is the average price of all goods and services in the economy. Assuming that Md = M, as the total amount of money in the economy is determined by the monetary authority, we get, M = k PY. Assuming that k is fixed and Y is at full employment level and is constant, we can see that M and P are directly proportional to each other, which is the same as the theory held by Fisher.

However, the classical quantity theory of money has a number of drawbacks. Firstly, in a dynamic economy V and T does not remain constant. Furthermore, the Y does not remain constant if the economy is not at full employment levels. Classical economists believed that the economy has a self-correcting mechanism, and would return to full employment levels in the long run. As a result, it is best to limit government intervention in the economy. Lastly and most importantly, money supply does not have a proportional effect on the price level, but affects the price level through changes in interest rate in the economy (Sriram, 1999). Due to these drawbacks, classical economists were unable to explain why the economy failed to correct itself during the Great Depression of 1929.

In an attempt to explain the failure of the economy to correct itself during this period, John Maynard Keynes published the General Theory of Employment, Interest and Money in 1936 and brought about a massive shift of thinking in economic theory. A Keynesian macroeconomist believes that the economy rarely operates at full employment level. Active help from both monetary and fiscal policy is necessary to bring the economy to full employment levels (Parkins et al., 2008). Keynes postulated that money was held for transactions, precautionary and speculative purposes. The speculative demand for money is the demand for highly liquid financial assets. Such assets are held in order to avoid capital losses from holding bonds or stocks. (Sriram, 1999). At low interest rates, the speculative demand for money is high. This is because, when the interest rates are low, people will expect an increase in interest rates in the future (which is associated with a higher return on asset holdings). Therefore, the demand for money is inversely related to interest rates. Similarly, higher income levels implied a higher demand for money. The overall demand for money function according to Keynes' was:

$$Md = f(y, i)$$

where, "y" is the real income and "i" is the nominal interest rate. Keynesian theory was the first to introduce the role of interest rates in determining the demand for real money balances (Sahadudheen, 2011).

According to Keynes, the velocity of transactions is not constant and the demand for money is inversely related to velocity (Serletis, 2007). As a result, an increase in money demand causes a decline in both the velocity of transactions and interest rates. Therefore, Keynes believed that the demand for money was not very sensitive to changes in interest rate and the demand for money curve is highly elastic. As a result, an increase or decrease of money supply due to monetary policy will not cause a significant change in interest rate (Parkins et al., 2008). Therefore, the impact of monetary policy on the economy as a whole is very low.

Friedman (1956) disagreed with Keynes's views that the impact of monetary policy on the economy is ineffective. He postulated that money was not only held for transaction purposes but as an asset. Therefore, individuals seek to maximize utility given their wealth which constitutes of money and other assets like bonds, equity, goods and human capital. The cost of holding money depends on the interest rate and the expected change in prices. If interest rates are high, other assets will yield a higher return than holding money. Consequently, individuals will demand less money as opposed to other assets. On the other hand, when the rate of inflation is high, the cost of holding money will increase as it loses value faster. Therefore, people will hold less money. The demand for money function in general form according to Friedman is:

$$Md = f\left(y, w, m, i, \frac{\Delta p}{p}\right)$$

where, "y" is the real income and "i" is the nominal interest rate on different assets, w is the ratio of non-human to human wealth, "m" includes the other factors which affect the preferences of individuals, "p" is the price level and $\frac{\Delta p}{p}$ is the rate of change of price (inflation).

Exchange rate has two opposing effects on domestic money demand, namely the wealth effect and currency substitution effect (Sahadudheen, 2011). If an individual holds foreign asset, for instance a foreign bond, a depreciation of domestic currency will imply an increase in the individual's wealth as the value of foreign assets held will increase. In response to the increase in wealth, the individual will invest in domestic assets and will therefore demand domestic currency. As a result, a depreciation of domestic currency will cause an increase in money demand. This effect is called the wealth effect. On the other hand, if currency depreciates, the opportunity cost of holding domestic currency as opposed to foreign currency is higher. Investors will form expectations of further currency depreciation in the future. As a result, they will increase their share of foreign assets in their portfolio. This will lead to an increase in demand for foreign currency and lower the demand for domestic currency. This effect is called the currency substitution effect. The net effect on money demand depends on the relative strength of the wealth effect and currency substitution effects.

Financial innovation is expected to have a positive relationship with money demand. Financial Innovation involves more efficient allocation of capital to productive investments and an increase in the overall pool of savings. The effective allocation of funds can affect the accumulation of physical and human capital as well as total factor productivity, which are three factors that determine economic growth. Therefore, we can say that financial innovation can increase the level of economic activity in the economy, and can increase the demand for money (Svirydzenka, 2016).

2.2 Review of Empirical Papers

There have been numerous attempts to investigate the determinants of money demand in Bangladesh. In this paper, we shall firstly present the literature on the determinants of money demand in the context of Bangladesh. Then we will present studies which attempted to investigate the relationship between financial innovation and demand for money. Since earlier work investigating the relationship between financial innovation and demand for money has not been done in the context of Bangladesh before, we shall look at this relationship in the literature from other countries.

The earliest attempt to investigate the demand for money function in Bangladesh after her independence was done by Ahmed (1977). The study uses annual data from 1959 to 1975, excluding data from 1971. Real money balance was the dependent variable, whereas real income and rate of interest (calculated as the weighted average of various deposit rates of major financial institutions due to nationalization which took place during this time) was taken as independent variables. In addition, three other dummy variables were introduced to represent structural chance, lagged income and rate of change of price level. The rate of change of price level was incorporated as a dummy due to high increases in price level in periods after independence in 1971. The paper found that the rate of interest is significant and negatively related to real money balances whereas income is positively related to real money balances. Murti and Murti (1978) used the same dataset of Ahmed (1977) but used a different method and obtained similar results.

Akhter (1993) used a partial adjustment model to estimate the short run demand for money in Bangladesh using seasonally adjusted quarterly data from 1976 Q4 to 1989 Q1. The independent variable was real money balances, whereas the dependent variables were real income, nominal interest rate, and expected rate of inflation (calculated by using the average of past inflation rates). The broad and narrow demand functions were investigated separately, and the narrow demand of money function was adjusted for autocorrelation using the AR1 method. The paper finds that real income and expected rate of inflation have a significant impact on both narrow and broad money demand functions, whereas the nominal interest rate does not have a significant relationship in either money demand functions. The coefficient of income has a positive sign, whereas the coefficients of the expected rate of inflation and interest rate have a negative sign. Akhter (2006) also used a similar method using annual data from 1973 to 2003 to estimate the money demand for Bangladesh to check whether the money demand function was stable during financial reforms and financial deregulation during early 1980s. The paper finds that both narrow and broad money demand functions have been stable since.

Taslim (1984) was the first to introduce expected inflation rate using rational expectations as a measure of opportunity cost of holding money instead of using nominal interest rate as the nominal interest rate was determined by institutions instead of by the market. Hossain (1992) used Chow and CUSUM and CUSUMSQ test to investigate the stability of both narrow and broad money demand function. He found that the narrow demand function was unstable due to the reforms which were undertaken in 1980s.

The first attempt to investigate the demand for real broad money (M2) was done by Siddiki (2000) using the Autoregressive Distributed Lag Approach (ARDL) to cointegration analyses using annual data from 1975 to 1995. Cointegration results show that there is a long-term relationship between real per capita broad money demand, real per capita income, domestic interest rate and foreign interest rate (measured by using unofficial exchange rate premiums as a percentage of unofficial exchange rates). The paper also finds that the demand for money in Bangladesh has been stable. Rao and Kumar (2009) used the Gregory and Hansen technique for structural breaks to investigate the relationship between real narrow money in Bangladesh and real income and nominal interest rate using annul data from 1973 to 2003. The study reveals that a cointegrating relationship exists between the variables. Hossain (2010) explored the behavior of broad money demand in Bangladesh using annual data from 1973 to 2008. The paper finds a stable relationship between inflation and money supply growth. Other notable works on the money demand relationship in Bangladesh were done by Ahmed (1977) and Akhter (2006).

Earliest studies on Financial Innovations on money demand in the United States have been conducted Goldfield (1976) and Gracia and Pak (1979). They have concluded that Financial innovations caused significant instability in money demand relationships. Milbourne and Moore (1986) has conducted similar studies for Canada to using quarterly seasonally adjusted data from 1955 to 1981. The four types of financial innovation which took place in Canada, namely: corporate cash management packages which was later extended to small firms (took place between 1976 and 1980), introduction of daily interest savings and chequing accounts (took place between 1979 to 1981) were incorporated into the money demand function using dummy variables. The study found that all financial innovations lead to a quick and proportionate downshift in the demand function for innovations between 1976 to 1980 and a slow and proportionate downward shift for innovations after 1979). Taylor (1987) estimated a demand for broad money (M3) for the United Kingdom using quarterly data from 1964 to 1985 by including the interest rate on chequing accounts as a proxy for Financial Innovation. Miller (1986) and Chirinko and Farr (1996) conducted historical investigations of financial innovations. Other notable works have been done by Swamy and Tavlas (1989), Kogar (1995) and Moghaddam (1997).

Augustine (1990) investigated the effect of financial innovations on the money demand function in Japan using quarterly data for two sample periods (1973 quarter 2 to 1981 quarter 4 and 1973 quarter 2 to 1986 quarter 4). This split was done to account for the major financial innovations that took place in Japan from 1979 to 1981. The study uses a dummy variable to capture the deregulation of financial markets in 1979. The study concluded that once a dummy variable for financial innovation was included in the money demand equation, a stable demand for money function existed.

Frame and White (2004) looked intensively into how empirical studies of financial innovation. He compiled several empirical papers, to better understand the different types of financial innovations and patterns of financial innovations. He looked into papers which looks into the environmental conditions which encourage financial innovations, the consequences and welfare aspects of financial innovations, process and organizational innovations, and diffusion. Mannah-Blankson and Belnye (2004) used two proxies, namely the volume of cash card transactions in the economy and M2/M1, as a measure of Financial Innovation in Ghana. The study used cointegration and error correction model for a time series quarterly data from 1992 to 2000. The other variables taken into consideration in the model are inflation, real GDP and real effective exchange rates. The paper finds a significant impact and positive impact on money demand in the long run. In the short run however, financial innovation lead to an increase in the demand for M1 and a decrease in the demand for M2. Kabir and Mangala (2006) complimented the study of Milbourne and Moor (1986) by using quarterly data from 1967 to 1985. The study found that that innovations have caused a shift in money demand function in the early 1980s in Canada.

Hye (2009) investigated the relationship between money demand and financial innovation in Pakistan by using monthly time series data from 1995 to 2007. The demand for broad money was used as the dependent variable in this study. The other variables are: Inflation, GDP as a measure of economic activity, interest rate and exchange rate. The measure for financial innovation was M1/M2. The paper uses the Johansen co-integration technique and finds four co-integrating vectors in money demand, interest rate, economic activity, inflation, financial innovation and exchange rate. The paper finds a positive and statistically significant impact of financial innovation on money demand in both the short and long run.

Following Klovland (1983), Akhtar (1983), Bordo and Jonung (1981) and Siklos (1993), Hafer and Kutan (2010) tested the impact of financial innovations on the long run demand for money in the Phillipines using data from 1980 to 1998 using a dummy variable for financial innovations. The main dependent variable used in this paper is real money balances. The independent variables used in this paper are real income (GNI) and the opportunity cost of holding money (measured by the interest rate on 91 days treasury bills). A dummy variable for financial innovations is applied here to capture the impact of shift of money demand due to financial innovations. It investigates the impact of M1 and M3 demand separately. The paper finds that a long-term relation exists between M1 and both GNI and interest rate when the dummy of financial innovation is included. However, such a relationship does not exist in the case of M3.

Malik and Aslam (2010) used the ARDL method and Error Correction Method (ECM) to investigate the impact of financial innovations on money demand in Pakistan in the long run and short run respectively using annual data from 1957 to 2008. This also used M2 as a function of demand for money. The variables used for the paper were: inflation, call money interest rate (proxy for opportunity cost of holding money) and GDP. The proxy for financial innovation was M2/M1. The paper finds that financial innovation does not exhibit a statistically significant relationship in the long run based on the ARDL results. However, in the short run, there is a positive relationship between financial innovations and demand for broad money. According to the co-integration analysis, all variables were significantly correlated to each other based on Vector Autoregressive test on trace and maximal Eigenvalue of stochastic matrix at 5% level of significance.

Dunne and Kasekende (2018) investigated the impact of different measures of financial innovation on the demand for money function in Sub Saharan Africa. A full unbalanced panel data was collected for 34 countries in Sub Saharan Africa, amongst which the balanced panel comprised of 17 countries. All data were collected from the World Bank Database between 1980 to 2013. Three methods were used, namely Dynamic Fixed Effects (DFE), Mean Group (MG) and Pooled Mean Group (PMG). The real money demand of narrow money (M1) was considered as the dependent variable in this study. The primary measure of Financial Innovation was the ratio of M2/M1. Other measures included domestic credit to private sector by banks as a percentage of GDP (defined as private sector credit growth), log of automated teller machines per 100,000 adults (defined as ATM concentration) and log of commercial bank branches per 100,000 adults (defined as Branch Concentration). Other variables included in the model were inflation based on CPI, Log of Real GDP and Exchange Rate. The study found a negative relationship and significant relationship between M2/M1 and real money demand in both the short and long run. Alternatively, the study found a significant and positive relationship for both branch concentration and ATM concentration with money demand, and a strong negative relationship for private sector credit growth.

Nnyanzi (2018) examined the indirect effect of financial innovation on money demand in Uganda using annual data from 1986 to 2017 using the ARDL method. The paper also uses the ratio M1/M2 as a proxy of measurement for financial innovation. The paper finds a positive long run relationship between financial innovation and real narrow money in both the short run and the long run. However, the paper fails to find evidence of the role of financial innovation on real broad money.

Regardless of intensive research done on the money demand and its determinants in Bangladesh, not much work has been done incorporating the effect of financial innovation into the money demand function. We will try to fill that gap through this study.

3. Methodology

3.1 Data and Variables

The objective of this paper is to investigate the impact of the growth rate of financial innovations on the growth rate of the demand for money in Bangladesh. This paper employs monthly data from 2002 to 2016. Data of broad money (M2), narrow money (M1), price level (Consumer Price Index, CPI), industrial price index, exchange rate and interest rates were taken from the International Financial Statistics (IFS) dataset of the International Monetary Fund (IMF).The sample period is chosen to have a coherent data set from a single source (IMF).BB mostly pursues M2 based targeting, as broad money is largely determined by Reserve Money (RM) through the money multiplier and by setting an operational target for RM accordingly (Monnin and Barkawi, 2015). Data of depository institutions' credit to private sector is obtained from the Integrated Monetary Database (IMD) of the IMF. Based on Friedman's definition of broad money (M2), we consider M2 as a function of the demand for money in the economy. Depository institutions' credit to private sector is used as a proxy for financial innovation. The variables and their description are given below:

Table 1: Definition of Variables and Sources
(All Denominations are in National Currency, Which is Taka)

Variables	Definition	Source
rmd	Real demand for broad money (M2). Calculated as the broad money in national currency divided by the CPI.	International Financial Statistics (IFS) Database, International Monetary
dicps	Depository institutions' credit to private sector, which refers to financial resources provided to the private sector by depository institutions. Resources include: Loans, purchase of non-	Integrated Monetary Database (IMD) for Bangladesh, International Monetary Fund
inrt	Short-term money market rates, which refers to the rate at which short-term government paper is issued in the market.	International Financial Statistics (IFS) Database, International Monetary
exrt	Exchange Rate (Taka per US Dollar).	International Financial Statistics (IFS) Database, International Monetary
ipi	Industrial production index. Used as a proxy for economic activity, as monthly data for GDP is unavailable.	International Financial Statistics (IFS) Database, International Monetary
cpi	Consumer Price Index. In this case, we have taken the first difference of the natural logarithm of CPI to get the inflation rate (Δlcpi).	International Financial Statistics (IFS) Database, International Monetary

3.2 Model Specification

The following demand for money function for Bangladesh is used in this study based on relevant theory:

$$rmd = \alpha_0 + \alpha_1 cpi + \alpha_2 exrt + \alpha_3 ipi + \alpha_4 dicps + \alpha_5 inrt + \varepsilon \ \ldots\ldots \ \mathbf{(1)}$$

where, *rmd* is the real demand for broad money (M2), *cpi* is the price level (consumer price index), *exrt*is the nominal exchange rate, *ipi*is the industrial production index which is used as a proxy for economic activity, *dicps* is the depository institutions' credit to private sector (proxy for financial innovation) and *inrt* is the interest rate. M2 divided by the CPI has been used as the proxy for real money demand as money demand is not directly observable. Broader forms of money (like M3 and M4) are not used in this study as the dependent variable, as the depth of financial market of Bangladesh is relatively lower comparted to the financial markets of developed countries.

3.3 Unit Root Test

All tests and regressions for this study have been conducted using STATA12. Before we begin the analysis of any relationship, it is important to examine the time series properties of each variable individually. Firstly, before we can conduct unit root test, it is important to determine the optimal lag length of each variable. This has been determined using the Akaike Information Criterion (AIC) as the sample size is sufficiently large. We then test the existence of unit root in the time series sample to determine the order of integration of each variable. In order to do so, we employ the Augmented Dickey-Fuller (ADF) test for unit root for the study. The result of the ADF test is presented in **Table 3** below.

Table 2: Summary of ADF Unit Root Test

Level					
Variables	**Optimal Lag**	**ADF test statistic**	**P value**	**Critical Value (1%)**	**Critical Value (5%)**
$lmrd_2$	9	-0.477	0.8964	-3.487	-2.885
lcpi	3	-0.376	0.9140	-3.485	-2.885
lexrt	2	-1.371	0.5960	-3.484	-2.885
lipi	14	0.780	0.9913	-3.488	-2.886
ldicps	15	-0.543	0.8834	-3.489	-2.886
inrt	3	-4.013	0.0013	-3.485	-2.885
First Difference					
Variables	**Optimal Lag**	**ADF test statistic**	**P value**	**Critical Value (1%)**	**Critical Value (5%)**
lmrd2	12	-3.045	0.0309	-3.488	-2.886
lcpi	12	-3.502	0.0079	-3.488	-2.886
lexrt	1	-9.279	0.0000	-3.484	-2.885
lipi	13	-3.830	0.0026	-3.488	-2.886
ldicps	14	-3.278	0.0159	-3.489	-2.886
inrt	-	-	-	-	-

Variables	**Order of Integration at level from ADF test**
lmrd2**	I(1)
lcpi**	I(1)
lexrt**	I(1)
lipi	I(1)
lfi	I(1)
inrt	I(0)

The null hypothesis of the ADF test states that the variable contains a unit root, whereas the alternative hypothesis states that the variable does not have a unit root and is generated by a stationary process. If the computed t-statistic exceeds the ADF critical values we reject the null hypothesis in favor of the alternative hypothesis which implies that the variable is generated by a stationary process. On the other hand, if the t-statistic does not exceed the ADF critical values then we fail to reject null hypothesis in favor of alternative, which implies that the variable contains a unit root and is not stationary (StataCorp, 1985). From Table 3, we can see that all the variables except interest rate has a unit root at level, but does not have a unit root after first differencing. Therefore, all variables except interest rates are integrated to order one at 5% critical values. Interest rate, however, is integrated to order zero as we can reject the null hypothesis as level. This is also reflected by the MacKinnon approximate p-value for

Z(t). At level, the p value is greater than 0.05 for all variables except interest rate, which implies that we fail to reject the null hypothesis. However, at first difference, the p-value for all variables except interest rate is less than 0.05. This implies that we can reject the null hypothesis and state that all variables are integrated to order one at level except interest rate, which is integrated to order zero.

3.4 Additions to model specification

Cointegration tests are used to analyze non stationary time series data (Rao, 2007). Since we are dealing with a non-stationary time series data in our study, we have to employ cointegration tests so that the results are not biased and misleading. Non stationary time series data usually do not meet the assumption that variance and means are constants that are independent of time (Rao, 2007). Therefore, classical methods like Ordinary Lease Squares (OLS) cannot be used.

Since the log specification is necessary in order to perform cointegration tests, we take the natural log of all variables except for the interest rate (as it is a rate itself and is cointegrated to order zero). We take the first difference of the natural log of CPI in our model, in order to analyze the impact of inflation on money demand. Therefore, equation (1) becomes:

$$lrmd = \alpha_0 + \alpha_1 \Delta lcpi + \alpha_2 lexrt + \alpha_3 lipi + \alpha_4 ldicps + \alpha_5 inrt + \varepsilon \ \ldots\ldots \ \mathbf{(2)}$$

The expected sign of each coefficient is provided in Table 3.

Table 3: Expected Sign of Coefficients

Independent Variable	Expected Sign of coefficient	Description
ldicps	Positive	With higher levels of financial innovation, the demand for money is expected to be higher due to higher accessibility and depth of financial institutions.
inrt	Negative	Interest rate is negatively related to money demand as per theory (explained in details in the theoretical framework).
lexrt	Ambiguous	The expected sign depends on the relative strength of the wealth effect and currency substitution effect.
lipi	Positive	Money demand is expected to be higher with higher levels of economic activity.
Δlcpi	Negative	Inflation is negatively related to money demand as per theory (explained in details in the theoretical framework).

Based on theory as specified in the theoretical framework, we know that the real demand for money is inversely related to inflation and interest rate, and positively related to the level of economic activity. As a result, we expect the sign of α_1 andα_5 to be negative and we expect the sign of α_2 to be positive. The impact of exchange rate on money demand is ambiguous, and it depends on the relative strength of the wealth effect and currency substitution effect. Therefore, the sign of α_5 is ambiguous. The expected sign of α_4 is positive as higher financial innovation leads to higher money demand.

3.5 Bounds Test for Cointegration

For our analysis, the best method to employ is the ARDL bounds test for cointegration proposed by Pesaran, Shin and Smith (2001). There are two main reasons for the choice of the ARDL bounds testing procedure. Firstly, it is simpler than multivariate cointegration procedures such as the Johansen and Juselius (1990) cointegration procedures. The method employs simple OLS to estimate cointegration relationship once the lag order is specified. Secondly, the procedure allows for a mixture of variables cointegrated to order zero and order one. A major drawback of this process is that it crashes if any of the variables are integrated to order 2 and above. Since all of our variables are integrated to order zero and one, the ARDL bounds testing approach can be used for our analysis.

We begin the bounds test procedure by modelling our long-run equation (equation 2 in our study) as a general vector autoregressive (VAR) model of order p, in z_t(Choong et al, 2005). The general form is:

$$z_t = c_0 + \beta_t + \sum_{i=1}^{p} \phi_i Z_{1-i} + \varepsilon_t,\ t = 1,2,3,\ldots,T \ \ldots\ldots\ldots\ \textbf{(3)}$$

where, c_o is a k+1 vector of intercepts (denotes the drift), and β represents the vector of trend coefficients.

From this equation, Pesaran, Shin and Smith (2001) derived the following conditional vector equilibrium correction model (VECM):

$$\Delta z_t = c_0 + \beta_t + \Pi z_{t-1} + \sum_{i=1}^{p} \Gamma_i Z_{1-i} + \varepsilon_t,\ t = 1,2,3,\ldots,T \ \ldots\ldots\ldots\textbf{(4)}$$

where the Π and Γ are (k+1)X(k+1) matrices which contain the long run multiplier and short run dynamic coefficients respectively. Z_t is the vector of all variables y_t and x_t. If there is a long-term relationship between the variables, the conditional VECM becomes:

$$\Delta y_t = c_{y0} + \beta_t + \delta_{xx} x_{t-1} + \sum_{i=1}^{p-1} \lambda_i \Delta y_{1-i} + \sum_{i=1}^{p-1} \xi_i \Delta x_{1-I} + \varepsilon_{yt},\ t = 1,2,3,\ldots,T \ \ldots\ldots\ldots\ \textbf{(5)}$$

In our analysis, the dependent variable is lrmd and the independent variables are Δlcpi, lexrt, lipi, ldicps and inrt. Based on this, the y_t in the above equation is an I(1) dependent variable lrmd, and x_t is a vector matrix of both I(0) and I(1) independent variables, x_t = [Δlcpi, lexrt, lipi, ldicps, inrt]. We assume that all the variables have identically and independently distributed (i.i.d.) zero mean error.

Following the method specified by Pesaran, Shin and Smith (2001) above, the conditional VECM for our study can be specified as:

$\Delta lrmd = c_0 + \delta_1\, lrmd_{t-1} + \delta_2\, \Delta lcpi_{t-1} + \delta_3\, lexrt_{t-1} + \delta_4\, lipi_{t-1} + \delta_5\, ldicps_{t-1} + \delta_6\, inrt_{t-1} + \sum_{i=1}^{p} \eta\, \Delta lrmd_{t-i} + \sum_{j=1}^{q} \varpi \Delta lcpi_{t-j} + \sum_{l=1}^{q} \phi lexrt_{t-l} + \sum_{m=1}^{q} \omega lipi_{t-m} + \sum_{n=1}^{q} \varphi ldicps_{t-n} + \sum_{r=1}^{q} \gamma inrt_{t-r} + \Psi D_t + \varepsilon_t$………….. **(6)**

Here, $\delta_i$are the long-term multipliers; ϖ, η, ϕ, ω, φ and γ are the short-term coefficients, c_0 is the drift and $\varepsilon_t$is the white noise.

The ARDL bounds test is done in three steps. The first step is to test for a long-term relationship among variables by using ARDL - Ordinary Least Square (OLS) on equation 6. The null hypothesis of the F-test of joint significance of the lagged levels of variables states that there is no cointegrating equation, whereas the alternative hypothesis states that there is cointegrating relationship between the variables. If the calculated F-statistic is greater than the upper bound, we can reject null hypothesis in favor of alternative hypothesis. In this case, a shock in the short run will cause a movement in the series of each variable, which will converge with time in the long run. If the F-statistic is lower than the smaller than the lower bound, we fail to reject null hypothesis in favor of alternative hypothesis. This implies that there is no long-term relationship between the variables. If the F-statistic falls between the lower and upper bounds, the result is inconclusive (Pesaran and Shin, 1997). Once a cointegrating relationship has been established, we can estimate the long run model for lrmd by using the conditional ARDL. The lags of each variables are chosen using the Akaike Information Criteria (AIC). The third step is to estimate the short-term parameters by using an error correction model associated with the long run estimates and the speed of adjustment.

4. Data Analysis and Empirical Results

4.1 ARDL Bounds Test

As all variables are integrated to order zero I(0) and order one I(1), we can use the ARDL bounds testing approach for cointegration as proposed by Pesaran, Shin and Smith (2001). The results of the bounds test are presented in the table below:

Table 4: Results of ARDL Bounds Test

Dependent Variable	F-statistics	Outcome
F(lrmd | ldicps, inrt, lexrt, lipi, Δlcpi)	9.99***	Cointegration
F(ldicps | lrmd, inrt, lexrt, lipi, Δlcpi)	2.26	No cointegration
F(inrt | lrmd, ldicps, lexrt, lipi, Δlcpi)	10.327***	Cointegration
F(lexrt | lrmd, ldicps, inrt, lipi, Δlcpi)	2.714	Inconclusive
F(lipi | lrmd, ldicps, inrt, lexrt, Δlcpi)	2.999	Inconclusive
F(Δlcpi | lrmd, ldicps, inrt, lexrt, lipi)	26.804***	Cointegration

Note: Lower bound I(0) = 2.62 and Upper bound I(1) = 3.79 at 5% level of significance. All variables are cointegrated at 10% level of confidence

The F-statistics of joint significance for F(lrmd | ldicps, inrt, lexrt, lipi, Δlcpi) is 9.99 which is higher than the upper bound critical value of 3.79 at 5% significance level. The F-statistics of F(inrt | lrmd, ldicps, lexrt, lipi, Δlcpi) and F(Δlcpi | lrmd, ldicps, inrt, lexrt, lipi) are 10.327 and 26.804 respectively, which are also higher than the upper bounds. Therefore, we can reject the null hypothesis in favor of alternate, which implies that there is a long-term cointegrating relationship amongst variables which normalized on lrmd, inrt and Δlcpi. Based on these results, lrmd can be used as the dependent variable as specified by our theory.

4.2 Long Run Money Demand Coefficients Using the ARDL Approach

Once we have established that a long run relationship exists between the variables when lrmd is the dependent variable, we can estimate the long run coefficients from equation 6. The results of our ARDL (2,4,4,3,4,4) model is shown in Table 5.

Table 5: Results: Long run coefficients of ARDL (2,4,4,3,4,4) Based on AIC. Dependent Variable is lrmd

Regressor	Coefficient	Standard Error	T Ratio	P Value
Constant	1.244723	0.83087	1.58**	0.117
ldicps	0.55538458	0.1032298	5.37***	0.000
inrt	-0.0004676	0.0002545	-1.84*	0.068
lexrt	-0.0819593	0.0745766	-1.10	0.274
lipi	0.0532586	0.0120874	4.41***	0.000
Δlcpi	-0.783156	0.098141	-8.02***	0.000

Note: *** denotes 1%, ** denotes 5% and * denotes 10% significance level

The findings are consistent with the expected sign of coefficients presented in section 3. A 1% increase in the proxy for financial innovation, depository institutions' credit to private sector, has a 0.56% increase in money demand if all other variables are constant. A 1% increase in economic activity, which is shown via the industrial production index in our model, causes the money demand to increase by 0.05%. Similarly, a 1% increase in inflation causes the money demand to fall by 0.78% if all other variables are kept constant. The depository institutions' credit to private sector, inflation and the level of economic activity have a significant impact on money demand (Significant at 1% and 5%).

Interest rate and exchange rate do not have a significant impact on money demand, as shown in Table 5. The expected sign of the coefficient of interest rate is negative, which is consistent with theory. However, a 1% increase in interest rate causes money demand to fall by 0.00046%, which is very small. From this, we can conclude that the money demand is not very sensitive to changes in interest rate. The coefficient of exchange rate is also negative, which implies that a depreciation of BDT in terms of

USD (increase in value of Taka/USD) will cause a fall in the demand for money. Therefore, the currency substitution effect in Bangladesh is greater than the wealth effect. However, the impact is not statistically significant at 5% levels. (Note: Interest rate is found to be significant at 10% levels).

4.3 Short Run Money Demand Coefficients Using Error Correction Model

The short-run dynamic coefficients of the associated long-term relationships are obtained from the Error Correction Model (ECM) are given below. The signs of the short run dynamics are maintained in the long run, except for that of inflation.

Table 6: Results: Short Run Coefficients of ARDL (2,4,4,3,4,4) based on AIC. Dependent Variable is lrmd

Regressor	Coefficient	Standard Error	T Ratio	P Value
Constant	1.244723	0.7889597	1.58	0.117
Δldicps	0.5124659	0.1103489	4.64	0.000
Δinrt	-0.000477	0.0003427	-1.39	0.166
Δlexrt	-0.0970358	0.0737087	-1.32	0.190
Δlipi	0.057427	0.0169357	3.39	0.001
ΔΔlcpi	0.4734719	0.1695181	2.79	0.006
ecm(-1)	-0.0781546	0.0493275	-1.58	0.115

R squared: 0.7098 Adjusted R Squared: 0.6611 Durbin-Watson d-statistics: 2.04

Here we can see that depository institution's credit to private sector, industrial production index and inflation are significant at 1% level. The equilibrium correction coefficient is estimated at -0.078 (0.115), which implies a convergence from short run to long run if a shock occurs. Approximately 7.8% of the disequilibria from the previous month converges back to the long run equilibrium in the current month. It's a fairly high speed of adjustment, considering the fact that we are working with monthly data.

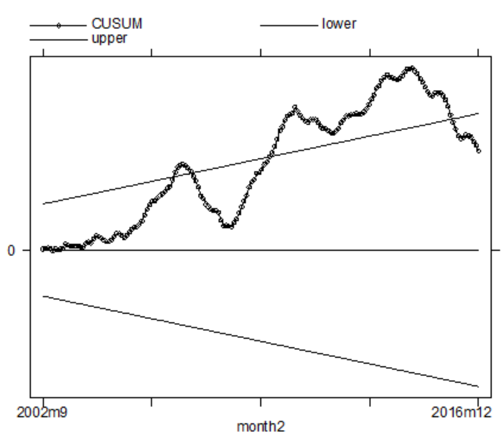
4.4 Diagnostic Tests

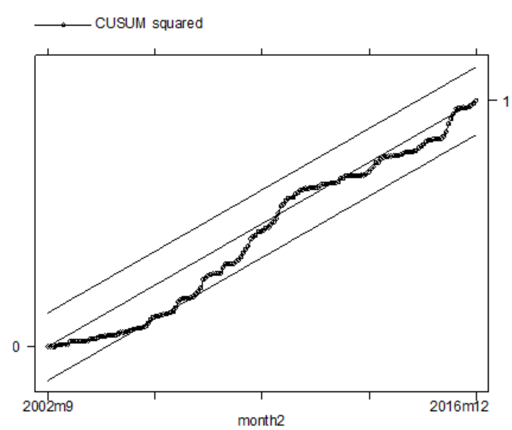
We carry out a number of diagnostic tests to check for serial correlation, functional form misspecifications, normality of errors and heteroskedasticity. For serial correlation, the Durbin Watson d-statistic has a value of 2.04064. This value is close to 2, which implies that there is very low serial autocorrelation. However, a better test to look for the existence of serial autocorrelation is the Breusch-Godfrey test. The Breusch-Godfrey test is a better test compared to the Durbin-Watson d statistics as it is less sensitive to the assumption that residuals are serially correlated. Furthermore, it allows us to test serial correlation through a number of lags. The null hypothesis of the Breusch-Godfrey test is that there is no serial correlation. In order to test for the Functional Form, we employ the Ramsey's RESET (Regression Equation Specification ErrorTest) using the square of the fitted values. The null hypothesis of the Ramsey's RESET test is that the model has no omitted variables. For normality and heteroskedasticity, we use the

JarqueBera test and the White's test of homoskedasticity respectively. The null hypothesis of the JarqueBera test shows that the p value will have a continuous uniform distribution between 0 and 1. The null hypothesis of the White's test is that here is homoskedasticity. The summary of the different tests is given in Table 7. We can see that, our model has passed for serial correlation and functional form at 5% levels, but have not passed normality and heteroskedasticity tests. According to Shrestha and Chowdhury (2005), heteroskedasticity is expected as an ARDL equation has a mixture of variables which are integrated to order zero and integrated to order one. The cumulative sum (CUSUM) and cumulative sum squared (CUSUMSQ) tests have also been carried out at 5% levels to test for stability. The CUSUMSQ is within the 5% bounds, however, some points exceed the CUSUM upper bound. According to Turner (2010), if the structural change involves a slope coefficient or the variance of the error term, then the CUSUMSQ test has higher power, even though the two tests often produce contradictory results.

Table 7: Diagnostic Tests

LM Test Statistics	
A Serial Correlation	$\chi^2(1) = 1.164\ (0.2805) > \alpha(0.05)$
B Functional Form	$\chi^2(1) = 1.64(0.1829) > \alpha(0.05)$
C Normality	$\chi^2(2) = 13.51\ (0.0012) < \alpha(0.05)$
D Heteroskedasticity	$\chi^2(1) = 175(0.4858) > \alpha(0.05)$
A Breusch-Godfrey LM test for autocorrelation B Ramsey's RESET test using the square of the fitted values C JarqueBera Test D White's test for Homoskedasticity	





5. Conclusion

Checking for a stable money demand function by taking into account financial innovations is necessary for accurate projections of the growth rate of money demand. But to the best of our knowledge no previous studies on Bangladesh has looked at the relationship between financial innovation and the demand for money. The main objective of the paper was to investigate the impact of financial innovations on money demand in Bangladesh. The study uses monthly data from 2002 to 2016, and uses "depository institution's credit to private sector" as a proxy for financial innovations. Other variables incorporated in this model includes interest rate, inflation rate, exchange rate and the level of economic activity (measured using the Industrial Production Index). The appropriate methodology chosen for the analysis is Error Correction Model (ECM). We begin our analysis with unit root testing using AIC in order to find the order of integration of variables. This is followed by ARDL bounds test to test for cointegration amongst variables. We then estimate the long-term coefficients using the ARDL approach, and the associated short-term coefficients using the ECM approach. The study finds a strong and significant positive relationship between money demand and financial innovations. Industrial production index (proxy for economic activity) is also found to be positively correlated with money demand function.These results are consistent with that of previous studies. Inflation, has a strong and significant negative relationship with money demand but interest rate, on the other hand, does not have a significant impact on money demand. This indicates that people consider expected inflation rate as a better measure of the opportunity cost of holding money than interest rate.The impact of exchange rate on money demand function is also insignificant. This may be due to the fact that in Bangladesh current account is not convertible and therefore changes in exchange rate does not alter the demand for local currency significantly.

6. Limitations and Scope for Further Research

This paper has a number of limitations, which can be expanded upon and improved in the future. The most noteworthy limitation of the paper is the choice proxy for financial innovations. We have used depository institutions credit to private sector as a proxy for financial innovation. The proxy is limited in a number of ways. Firstly, it only represents one aspect of financial innovations, which is financial depth. A perfect proxy will be able to capture all three aspects of financial innovations, which are: accessibility, depth and efficiency. Secondly, it only captures the characteristics of financial systems, and not the underlining drivers such as institutional, regulatory and legal framework (Svirydzenka, 2016). Thirdly, the paper fails to include mobile banking, direct debits and credit transfers in its analysis. These aspects are undoubtedly important, as new innovations like Bkash are being widely used in Bangladesh currently. These innovations have greatly contributed to a fall in transaction costs (money can now be sent at quickly between greater distances without going through an intermediary). Therefore, they have contributed to an increase in the velocity and the number of transactions in the economy, which have a positive impact on money demand. Lastly, the proxy fails to incorporate the diversity of financial intermediaries and organizational complexities of institutions and instruments (Svirydzenka, 2016). Efforts to collect data relating to financial accessibility and efficiency can be made on a macro level so that a better proxy for financial innovation can be found.

The second limitation of the paper is the usage of industrial production index as an indicator of economic activity. We have chosen to use this indicator as monthly data of Gross Domestic Product, or total output is not available. Our choice of indicator limits the impact of economic activity on money demand to the manufacturing sector. It fails to take into account the two largest sectors in the country, the service sector and the agricultural sector. We were unable to do so due to limitations in the availability of data from secondary sources.

Other important limitations like data unavailability and time constraints influenced the interpretations of the findings of our research. As we have limited our study to Bangladesh only, data was unavailable for most variables in our study before 2002. The study can be expanded to include other countries, like India, Pakistan and Sri Lanka to overcome this problem.

References

Ahmed, S. (1977). Demand for money in Bangladesh: Some preliminary evidences. *The Bangladesh Development Studies*, *5*(2), 227-238.

Akhtar, M. A. (1983). Financial innovations and their implications for monetary policy: Aninternational perspective. BIS Economic Papers, (9), 5-57.

Bordo, M., &Jonung, L. (1981). The long-run behaviour of the income velocity of money in five advanced countries, 1879-1975: An Institutional Approach, Economic Inquiry, 19, 96-116

Chirinko, R. S., & Farr, D. D. (1996). Financial innovations, money demand, and disaggregation: Some Time Series Evidence, Research Working Paper 96-06, Federal Reserve Bank of Kansas City

Dunne, J. P., &Kasekende, E. (2018). Financial Innovation and Money Demand: Evidence from Sub‐ Saharan Africa. South African Journal of Economics, 86(4), 428-448.

Frame, W. S., & White, L. J. (2004). Empirical Studies of Financial Innovation: Lots of Talk, Little Action?. Journal of Economic Literature, 42(1), 116-144.

Garcia, G., & Pak, S. (1979). Some clues in the case of the missing money. The American Economic Review, 69(2), 330-334.

Goldfeld, S. M. (1976), The Case of the Missing Money. Brookings Papers on Economic Activity, 3, 683-740.

Hafer, R. W., &Kutan, A. M. (2003). Financial Innovation and the Demand for Money: Evidence from the Philippines. International Economic Journal, 17(1), 17-27

Hossain, A. A. (2010). Monetary targeting for price stability in Bangladesh: How stable is its money demand function and the linkage between money supply growth and inflation?. Journal of Asian Economics, 21(6), 564-578.

Hossain, A. (1993). Financial reforms, stability of the money demand function and monetary policy in Bangladesh: an econometric investigation. Indian Economic Review, 85-100.

Hossain, M. A. (2000). Exchange Rates, Capital Flows, and International Trade: The Case of Bangladesh. University Press.

Hossain, A. (2006). The Income And Interest Elasticities Of Demand For Money In Bangladesh: 1973-2003. The IUP Journal of Monetary Economics, 4(2), 73-96.

Hye, Q. M. A. (2009). Financial Innovation and Demand for Money in Pakistan. doi: https://www.researchgate.net/publication/200475873_Financial_Innovation_and_Demand_for_Money_in_Pakistan

International Monetary Fund. (2016). International Financial Statistics, International Monetary Fund.

Johansen, S., &Juselius, K. (1990). Maximum likelihood estimation and inference on cointegration—with applications to the demand for money. Oxford Bulletin of Economics and statistics, 52(2), 169-210.

Kabir, M., &Mangla, I. (1988). Effects of financial innovations on the money demand function: A Canadian evidence. Applied Economics, 20(9), 1263-1273.

Klovland, J. T. (1983). The demand for money in secular perspective: The case of Norway, 1867–1980. European Economic Review, 22(2), 193-218.

Kogar, C. (1995). Financial innovations and monetary control, Discussion Papers 9515, Research and Monetary Policy Department, Central Bank of the Republic of Turkey.

Malik, Q. U. Z., & Aslam, Q. (2010). Effect of Financial Innovations on Demand for Money in Pakistan: An ARDL Approach. Paradigms: A Research Journal of Commerce, Economics and Social Sciences, 4(1), 1-23

Mannah-Blankson, T., &Belnye, F. (2004). Financial Innovation and the Demand for Money in Ghana. Bank of Ghana, Accra, 1-23.

Milbourne, R. (1986). Financial Innovation and the Demand for Liquid Assets: Note. Journal of Money, Credit and Banking, 18(4), 506-511.

Milbourne, R., & Moore, H. A. (1986). Some Statistical Evidence on the Effects of Financial Innovation. The Review of Economics and Statistics, 521-525.

Miller, M. H. (1986). Financial innovation: The last twenty years and the next, Journal of Financial and Quantitative Analysis 21(4), 459-471.

Moghaddam, M. (1997). Financial innovations and the interest elasticity of money demand: evidence from an Error Correction Model. Atlantic Economic Journal, 25(2), 155-163.

Monnin, P., &Barkawi, A. (2015). Monetary Policy and Sustainability. The Case of Bangladesh, Discussion Note 1501, Council on Economic Policies.

Murty, G. V. S. N., &Murty, S. (1978). The functional form of the demand for money in Bangladesh. The Bangladesh Development Studies, 443-460.

Nnyanzi, J. B. (2018). The Interaction Effect of Financial Innovation and the Transmission Channels on Money Demand in Uganda. International Journal of Economics and Finance, 10(12)

Patinkin, D. (1972). On the short-run non-neutrality of money in the quantity theory. PSL Quarterly Review, 25(100).

Pesaran, M. H., Y. Shin, and R. Smith (2001). Bounds testing approaches to the analysis of levelrelationships. Journal of Applied Econometrics 16(3): 289–326.

Pesaran, H. H., & Shin, Y. (1998). Generalized impulse response analysis in linear multivariate models. Economics letters, 58(1), 17-29.

Rahim, A. M. A., &Sohrabuddin, M. (1988). Central Banking, Monetary Management and Related Issues with Reference to Bangladesh Experience. Bangladesh Journal of Political Economy, 8(1), 182-201.

Rao, B. (2007). Cointegration for the Applied Economist. Palgrave Macmillan

Rao, B. B., & Kumar, S. (2009). Cointegration, structural breaks and the demand for money in Bangladesh. Applied Economics, 41(10), 1277-1283.

Sahadudheen, I. (2011). Demand for money and exchange rate: Evidence for wealth effect in India. Undergraduate Economic Review, 8(1), 15.

Shrestha, M. B., & Chowdhury, K. (2005). ARDL modelling approach to testing the financial liberalisation hypothesis, Economics Working Paper Series 2005, University of Wollongong.

Siklos, P. L. (1993). Income velocity and institutional change: some new time series evidence. 1870-1986, Journal of Money, Credit and Banking, 25 (3), 377-92

Sriram, M. S. S. (1999). Survey of Literatureon Demand for Money: Theoretical and Empirical Work with Special Reference to Error-Correction Models. International Monetary Fund.

StataCorp, L. P. (1985). Stata survey data reference manual.

Svirydzenka, K. (2016). *Introducing a new broad-based index of financial development*. International Monetary Fund.

Swamy, P. A., &Tavlas, G. S. (1989). Financial deregulation, the demand for money, and monetary policy in Australia. *Staff Papers*, 36(1), 63-101.

Taslim, M. A., & Chowdhury, A. (1995). Macroeconomic analysis for Australian students. Prentice Hall.

Taylor, M.P. (1987). Financial innovation, inflation and the stability of the demand for broad money in the United Kingdom. *Bulletin of Economic Research*, 225-233.

Turner, P. (2010). Power properties of the CUSUM and CUSUMSQ tests for parameter instability. Applied Economics Letters, 17(11), 1049-1053.

World Bank. International Economics Department Development Data Group. (2016). *World Development Indicators*, World Bank.