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Determinants of Money Supply in Bangladesh: An Empirical Investigation

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Abstract

Prudent management of money supply is considered as a key factor in smoothing macroeconomic stability. The better performance of monetary policy lies in attaining optimum management of money supply and stability in price level. As money supply plays key role in macroeconomic stability, the current paper attempt to explore the dynamic relationships between the money supply and its major determinants in Bangladesh. It applies the Autoregressive Distributed Lag (ARDL) model to assess the degree of influence of various factors on the money supply in Bangladesh using monthly data from 2008M1 to 2024M12. The findings indicate that the reserve money and the reserve-deposit ratio are the major contributors influencing the money supply in Bangladesh. In addition, currency-deposit ratio, excess reserve-deposit ratio, deposit rate, and exchange rate also affect the money supply. Since these factors have impacts over the money supply, the conduct of prudent monetary policy in Bangladesh will depend crucially on considering the implications of changes in those key factors.

Keywords: Money Supply, Monetary Policy, Macroeconomic Stability, Bangladesh.
JEL Classification: E51, E52, E58

1 Introduction

Money supply is a crucial economic factor which is thought to be essential for determining a country's macroeconomic stability, price levels, and the financial health. It can directly affect the inflation, interest rates, and economic growth, and thus assists to achieve the overall goals of an economy. In the context of Bangladesh economy, the money supply is regulated and controlled by the central bank (Bangladesh Bank), for impacting liquidity conditions of the banking system by utilizing various policy instruments and tools. Therefore, identifying key determinants of the money supply and their level magnitude will definitely help for formulation and implementation of the monetary and credit policy in Bangladesh.

Money supply (also known as money stock), refers to the sum total of the monetary assets available in an economy at a particular point in time. It includes currency in circulation and all sorts of bank deposits that the account holder can easily convert into liquid asset. Usually, combination of two types of paper currency or coins make out the whole monetary system, one is government issued and another is central bank notes. As monetary authority, Bangladesh Bank changes the money stock in align with sustained policies and regulatory decisions. Historical data analysis implies close relationship between the money supply and other macroeconomic variables such as nominal gross domestic prod-

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uct (GDP), and inflation (price level).M2 (a measure of money supply) has consistently remained at or above 40% of nominal GDP in Bangladesh throughout the study period (Figure 1).

1.1 Measures of the Money Stock

For Bangladesh economy, components of money supply can be classified into different aggregates. Firstly, M1 (narrow money) is the sum of currency in circulation and demand deposits from banking system. Then, M2 (broad money) refers to summation of M1 and the time deposits (including savings deposits). Another term is also used, M3 which is the sum of M2 and large time deposits and other liquid assets. In practice, M2 is more applicable for determining the money supply in an economy. As for the source side of M2, net foreign asset (NFA) and net domestic asset (NDA) altogether make up M2 (Figure 2).

In terms of determinants, there are several factors influencing the money supply in Bangladesh. Broad money (M2) has been considered as the intermediate target for monetary aggregate targeting policy framework, while Reserve Money (High-Powered Money) is thought to be the operating target in monetary policy formulation. Reserve money, includes currency in circulation and the reserves of commercial banks with Bangladesh Bank. Changes in reserve money directly affect the broad money, which is known as money multiplier approach. In this approach, money multiplier depends on factors like the currency-deposit ratio and the reserve requirement set by Bangladesh Bank.

Bangladesh Bank also employs other policy tools such as open market operations (OMO), the cash reserve ratio (CRR), and the statutory liquidity ratio (SLR) to control the money stock. Besides, government borrowing and the fiscal policy could also influence the money supply, whereas foreign exchange reserves along with balance of payment may possibly impact the currency holding demand of the public. People awareness on inflation rate can also alter the public demand for money, and becomes unpredictable and volatiles in times of emergency or crisis.

The study contributes by providing updated empirical evidence on the determinants of money supply in Bangladesh using monthly data from 2009 to 2024. Unlike earlier studies that relied on annual or quarterly data and shorter sample periods, the use of recent high-frequency data allows a more detailed analysis of both short-run and long-run dynamics. By applying the ARDL bounds testing approach, the study captures the long-term equilibrium and short-term adjustments between broad money (M2) and its determinants, including reserve money, currency-deposit ratio, reserve-deposit ratio, excess reserve-deposit ratio, deposit rate, and exchange rate.

The findings extend previous empirical evidence by showing that reserve money and the reserve-deposit ratio are the most significant determinants of money supply in Bangladesh, while other variables also influence money supply dynamics. These results refine earlier studies by reassessing the relative importance of monetary factors in the current economic context. Consequently, the study provides updated policy-relevant insights that may assist policymakers in managing liquidity and conducting effective monetary policy in Bangladesh.

Following the discussion above, exploring the key determinants of money supply in Bangladesh by using an appropriate statistical method is a very significant study. Because, it is crucial to identify the role of money stock determinants and suggest any possible recommendations, which shall be conducive for policy makers and think tanks/economists. To do so, the rest of this paper goes as follows: Section 2 presents the broad objectives of the study. Section 3 briefly narrates literature reviews including the theoretical background.

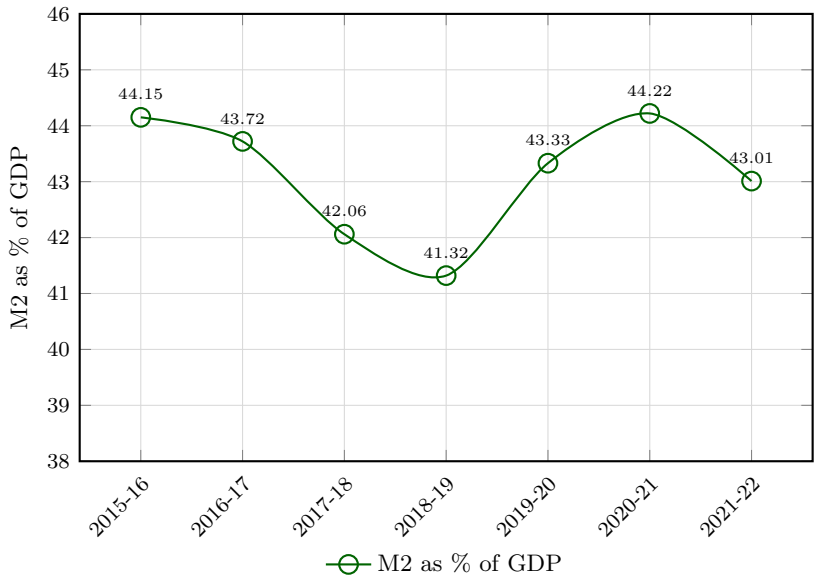

Figure 1: Movement of M2 as a Percentage of GDP
Source: Bangladesh Bank and Bangladesh Bureau of Statistics (BBS).

Then, data description and methodological idea are shown in Section 4, whereas results and findings are explained in Section 5. Finally, Section 6 concludes the work with policy recommendations.

2 Objectives of the Study

The main aim of the study is to explore the determinants of money supply in Bangladesh. In other words, specific objectives are elaborated as:

1. To explore the determinants of money supply in Bangladesh.
2. To assess the magnitude of these factors affecting the money supply in Bangladesh.
3. To suggest recommendations that may be conducive for policy makers.

3 Literature Review

Though there are many studies on money supply and related issues in developed and developing countries, only a few are available in the Bangladesh economy. For instance, Islam (2008) examined the money supply process in Bangladesh, while Sultana et al. (2019) and Kader et al. (2020) explored the relationship between money supply and macroeconomic variables.

3.1 Theoretical Framework

In the Classical view of money supply determinants, several economic indicators such as minimum required reserve rate and liquidity ratios are identified as the determinants of money supply (Handa, 2008). From the Monetarists point of view, "primate factor" matters in the determination of money supply. The primate factor consists of monetary base (high-powered money), constituting currency and coins outside the banking system (i.e., notes and coins held by the public) plus the deposits of commercial banks with the apex bank, reserve and currency ratios (Adediyan, 2020). Different from the classicist or monetarist views, the Keynesians and Post Key-

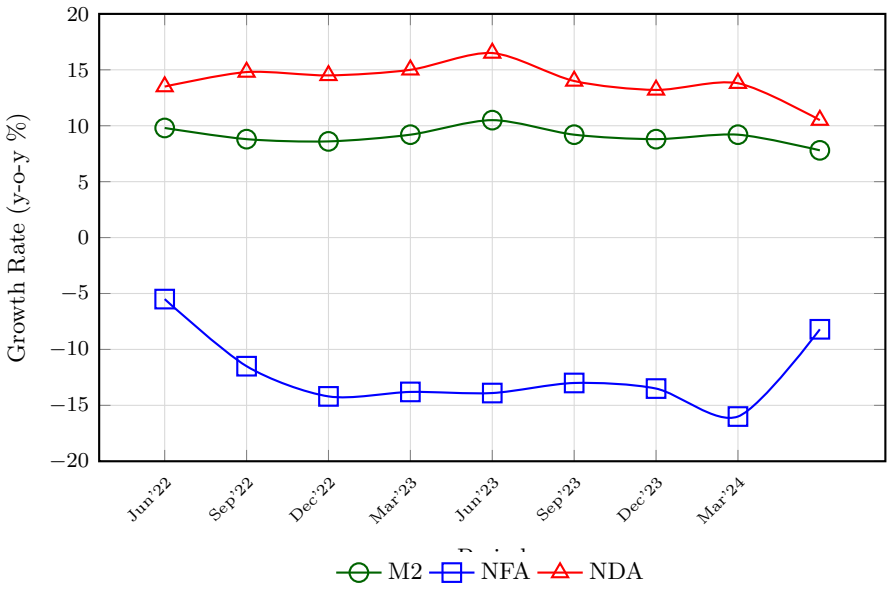

Figure 2: Growth Rate (y-o-y) of M2, NFA, NDA
Source: Bangladesh Bank.

nesians economists emphasized on variables including income, interest rate and economic activities as factors important for the determination of money supply (Fontana, 2003).

Following the Monetarists view of determinants, linkage between reserve money and money stock can be defined through simple money multiplier approach (Adediyan, 2020).

$$M2 = mm \times RM \tag{1}$$

Herein, $M2$ = monetary aggregate (or money supply), mm = money multiplier, and RM = reserve money (or high powered money). Islam (2008) also argued that the mm movement depends on factors such as currency-deposit ratio, reserve-deposit ratio, and the excess reserve-deposit ratio. Using the mathematical illustration of the money multiplier model provided by Goodhart (2017), equation (1) turns to be:

$$M2 \equiv \frac{(1+cd)}{(rd+cd)} RM \tag{2}$$

Herein, cd = currency-deposit ratio and rd = reserve-deposit ratio.

Many research studies identified the impact of money stock on inflation, interest rates, and economic growth. Excessive growth in money supply may lead to create inflationary pressure, while tightening money supply policies can slow down economic activities.

3.2 Empirical Works

Worldwide, money supply process and finding its determinants has been widely a research work. But researchers' method differs from way of thinking and following various approaches discussed above. For example, Shirvani and Bayram (2013) examined changes in the relative importance of the determinants of the US money supply using co-integration approach and dominance analysis. Their findings suggested currency ratio to be the main

determinant of the US money stock, while for financial crisis period 2008-2009, bank excess reserves ratio emerged as an equally important factor.

For the Indian context, Dash and Goyal (2000) commented monetary policy broadly succeeded in preventing an explosive growth in money supply and reined in inflationary expectations. They opined that monetary contraction should be completed earlier than in the past, and should coincide with a rise in food prices. Tiwari (2016) analysed major money supply determinants for Nepal using data from FY2004/05 to FY2014/15. That study found reserve money as the best determinant for money supply, whereas net foreign assets found major determinant for reserve money, and time deposits to demand deposits ratio as significant determinant for money multiplier.

Ahmed et al. (2015) empirically examined the money supply process in Bangladesh on basis of post liberalization period using annual time series data from 1972/73 to 2009/10. Researchers' finding showed remittance as the most significant factor that highly influencing on narrow and broad money supply in Bangladesh. Another study investigated the dynamic relationships among the money multiplier and RM components in the money supply process in Bangladesh (Islam, 2008). That work applied structural vector auto regression (SVAR) model using quarterly data for the period from 1979:Q3 to 2007:Q2, and the results exhibited that the currency-deposit ratio component in the multiplier model and net government borrowing, and movement of net foreign asset components in RM are the major contributors to changes in money supply.

Kader et al. (2020) applied advanced econometric tools like causality tests, error-correction mechanism, and co-integration approach for investigating the causal nexus between money stock and macroeconomic variables in Bangladesh. Reverse causation from broad money to both real GDP and the rate of inflation was found by this study. However, Sultana et al. (2019) using monthly data from May 2010 to December 2017 for Bangladesh economy, confirmed money supply not affecting the inflation in short-run and it was false in vice-versa, while in the long run, depicting a bi-directional causal relationship of money supply to inflate.

Adediyan (2020) tried to identify the influence of financial liberalization on money supply for Nigerian economy using annual data from 1980 to 2019 and applying Autoregressive Distributed Lag (ARDL) approach. The researcher found financial liberalization an important factor for determining money stock in Nigeria, along with currency ratio, required reserve ratio and high-powered money. In addition to that, Osuji and Ekeagwu (2021) extended the idea regarding money supply determinants for Nigerian economy utilizing annual data from 1981 to 2019. Applying ARDL bound testing model, authors empirically proved that inflation rate, gross domestic product growth and monetary base are the major determinants of money supply in Nigeria both in the long run and short run.

The literature review has been revised to provide a more critical synthesis of previous studies and to highlight methodological differences. Earlier studies on Bangladesh used different approaches and datasets, such as SVAR with quarterly data (Islam, 2008) and annual time-series analysis focusing on remittances as a determinant of money supply (Ahmed et al., 2015). Other studies, such as Sultana et al. (2019), mainly examined the relationship between money supply and inflation rather than directly identifying its determinants. International studies also applied diverse methods and found different key determinants depending on the country and methodology used.

However, several gaps remain in the literature. Many studies rely on annual or quarterly data and often analyze limited variables,

which may not fully capture the dynamic process of money supply determination. To address these gaps, the present study uses recent monthly data from 2009 to 2024 and applies the ARDL bounds testing approach to analyze both short-run and long-run relationships between money supply and its determinants in Bangladesh.

4 Data and Methodology

4.1 Data

A sample of monthly data from FY09 to FY24 was used to determine the long-term co-integration between the model's dependent variable and regressors. The data was obtained from the Monthly Economic Trends report of the Bangladesh Bank's Statistics Department. The study also includes major shocks such as the COVID-19 pandemic and recent monetary policy changes. To account for possible structural breaks, the study incorporates a crisis dummy variable to capture the impact of the pandemic, acknowledging that money demand may become unstable during crisis periods. The stability of the estimated relationships is tested using CUSUM and CUSUMSQ tests, which indicate that the regression coefficients remain stable within the 5% significance bounds. This suggests that both the long-run and short-run relationships between Broad Money (M2) and its key determinants such as Reserve Money and the Reserve-Deposit Ratio remain statistically robust despite the shocks.

4.2 Methodology

4.2.1 Model Specification

The econometric model is specified to assess whether these explanatory variables influence the money supply in Bangladesh as follows:

$$(M2)_t = \alpha_0 + \beta_1(RM)_t + \beta_2(CDR)_t + \beta_3(RDR)_t + \beta_4(ERDR)_t + \beta_5(DR)_t + \beta_6(ER)_t + \mu_t \quad (3)$$

Where,

Table 1: Variable Description

Variable	Description	Type
M2	Broad Money Supply	Dependent Variable
RM	Reserve Money (High Powered Money)	Independent Variable
CDR	Currency-Deposit Ratio	Independent Variable
RDR	Reserve-Deposit Ratio	Independent Variable
ERDR	Excess Reserve-Deposit Ratio	Independent Variable
DR	Deposit Rate	Independent Variable
ER	Exchange Rate	Independent Variable
μ_t	Error Term	

Dependent Variable

M2: Broad Money Supply

This is the dependent variable in the model, representing the total money supply in an economy, including currency in circulation, demand deposits, and time deposits. The model seeks to explain how various macroeconomic factors influence M2.

4.2.2 Explanatory Variables

The explanatory variables included in the model and their expected signs are summarized in Table 2.

Reserve Money is also known as base money; it consists of currency issued by the central bank and commercial banks' reserves. An increase in reserve money is expected to ex-

pand the money supply through the money multiplier effect.

CDR: Currency-Deposit Ratio

This ratio measures the proportion of currency held by the public relative to deposits in banks. A higher ratio indicates more cash in circulation and less deposit creation, which may reduce the overall money supply.

Table 2: Summary of Explanatory Variables and Expected Signs

Variable	Description	Expected Sign
RM	Reserve Money (High Powered Money)	+ (Positive)
CDR	Currency-Deposit Ratio	− (Negative)
RDR	Reserve-Deposit Ratio	− (Negative)
ERDR	Excess Reserve-Deposit Ratio	− (Negative)
DR	Deposit Rate	+/− (Ambiguous)
ER	Exchange Rate (BDT/USD)	+/− (Ambiguous)

RM: Reserve Money

RDR: Reserve-Deposit Ratio

The proportion of commercial banks' reserves to total deposits. A higher ratio means banks are holding more reserves instead of lending, which can restrict money supply growth.

ERDR: Excess Reserve-Deposit Ratio

This ratio represents the amount of reserves banks hold beyond the required reserves relative to their deposits. Higher excess reserves may indicate lower lending activity, reducing money supply growth.

DR: Deposit Rate

This is the interest rate paid by banks on deposits. A higher deposit rate could incentivize individuals to save more, which could influence the overall money supply by affecting deposit behavior.

ER: Exchange Rate (Taka per US Dollar)

The exchange rate reflects the value of the Bangladeshi Taka (BDT) relative to the US Dollar. Changes in the exchange rate can affect imports and exports, inflation, thereby affecting the money supply.

α_0 and μ_t represent the intercept and white noise error term, respectively. The model aims to analyze how these macroeconomic variables impact the money supply in Bangladesh. The coefficients ($\beta_1, \beta_2, \beta_3, \beta_4, \beta_5$, and β_6) represent the elasticity of M2 with respect to each variable, helping policymakers understand the key drivers of liquidity in the financial system.

The selection of variables in this study is based on the theoretical framework of the money multiplier model, which explains money supply through reserve money and banking behavior variables such as the currency-deposit ratio, reserve-deposit ratio, and excess reserve-deposit ratio. These variables directly influence the process of money creation in the banking system. In addition, deposit rate and exchange rate are included to capture the effects of financial incentives and external sector dynamics on money supply.

Macroeconomic variables such as inflation, government borrowing, or fiscal deficit are not included because the study focuses specifically on the structural monetary determinants of money supply rather than its broader macroeconomic consequences. However, the model partially captures macroeconomic influences through the inclusion of the exchange rate and a crisis dummy variable for the COVID-19 period. Future research may incorporate additional macroeconomic variables and conduct robustness checks to further strengthen the analysis.

4.3 Estimation Technique

4.3.1 Testing Stationarity

The unit root test is just an alternative to the correlogram for assessing stationarity. Stationarity tests incorporate mainly the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests.

Augmented Dickey-Fuller (ADF) Test According to Dickey and Fuller (1981), $\Delta M2_{t-i}$ can be included as a lagged difference term to address serial autocorrelation. The equations for the ADF test, including both trend and intercept, in our model are as follows:

The equations for the ADF test, including both trend and intercept, in our model are as follows:

$$\Delta M2_t = \alpha_0 + \alpha_1 M2_{t-1} + \alpha_2 t + \sum_{i=1}^{n} \beta_i \Delta M2_{t-i} + \varepsilon_t \quad (4)$$

$$\Delta M2_t = \alpha_0 + \alpha_1 M2_{t-1} + \alpha_2 t + \sum_{i=1}^{n} \beta_i \Delta M2_{t-i} + \varepsilon_t \quad (5)$$

$$\Delta RM_t = \alpha_0 + \alpha_1 RM_{t-1} + \alpha_2 t + \sum_{i=1}^{n} \beta_i \Delta RM_{t-i} + \varepsilon_t \quad (6)$$

$$\Delta CD_t = \alpha_0 + \alpha_1 CD_{t-1} + \alpha_2 t + \sum_{i=1}^{n} \beta_i \Delta CD_{t-i} + \varepsilon_t \quad (7)$$

$$\Delta RD_t = \alpha_0 + \alpha_1 RD_{t-1} + \alpha_2 t + \sum_{i=1}^{n} \beta_i \Delta RD_{t-i} + \varepsilon_t \quad (8)$$

$$\Delta ERD_t = \alpha_0 + \alpha_1 ERD_{t-1} + \alpha_2 t + \sum_{i=1}^{n} \beta_i \Delta ERD_{t-i} + \varepsilon_t \quad (9)$$

$$\Delta DR_t = \alpha_0 + \alpha_1 DR_{t-1} + \alpha_2 t + \sum_{i=1}^{n} \beta_i \Delta DR_{t-i} + \varepsilon_t \quad (10)$$

$$\Delta ER_t = \alpha_0 + \alpha_1 ER_{t-1} + \alpha_2 t + \sum_{i=1}^{n} \beta_i \Delta ER_{t-i} + \varepsilon_t \quad (11)$$

Where $\Delta M2_t$, ΔRM_t, ΔCD_t, ΔRD_t, ΔERD_t, ΔDR_t, and ΔER_t are the first differences for M2, RM, CD, RD, ERD, DR, and ER respectively. ε_t represents the white noise error term.

Phillips-Perron (PP) Test The equations for the PP test in our model are as follows:

$$\Delta M2_t = \alpha_0 + \alpha_1 M2_{t-1} + \varepsilon_t \quad (12a)$$
$$\Delta RM_t = \alpha_0 + \alpha_1 RM_{t-1} + \varepsilon_t \quad (12b)$$
$$\Delta CD_t = \alpha_0 + \alpha_1 CD_{t-1} + \varepsilon_t \quad (12c)$$
$$\Delta RD_t = \alpha_0 + \alpha_1 RD_{t-1} + \varepsilon_t \quad (12d)$$
$$\Delta ERD_t = \alpha_0 + \alpha_1 ERD_{t-1} + \varepsilon_t \quad (12e)$$
$$\Delta DR_t = \alpha_0 + \alpha_1 DR_{t-1} + \varepsilon_t \quad (12f)$$
$$\Delta ER_t = \alpha_0 + \alpha_1 ER_{t-1} + \varepsilon_t \quad (12g)$$

Where $\Delta M2_t$, ΔRM_t, ΔCD_t, ΔRD_t, ΔERD_t, ΔDR_t, and ΔER_t are the first differences for M2, RM, CD, RD, ERD, DR, and ER respectively. ε_t represents the white noise error term.

4.3.2 Autoregressive Distributed Lag (ARDL) Model

Some of the variables in our model are stationary at I(1), while others are at I(0), a combination of both. Therefore, it suggests applying the ARDL Bounds testing approach (Pesaran et al., 2001).

Using this approach, we can assess the long- and short-term co-integration between the money supply in Bangladesh and the explanatory variables of the model.

Assumptions of the ARDL Model

The Autoregressive Distributed Lag (ARDL) model relies on several key assumptions to ensure its validity and reliability. First, there should be no autocorrelation. Second, the model assumes no heteroscedasticity. Third, the residuals must follow a normal distribution. Fourth, the stationarity of variables is crucial, meaning that the time series should be either integrated at I(0) or I (1), but not at I(2). Finally, the stability of the model is essential to ensure its reliability, which is tested through CUSUM and CUSUMSQ tests.

The OLS estimation technique is adopted in the ARDL-bound testing approach to estimate a conditional, unconstrained error correction model (ECM).

The equation can be symbolized in the following way using this method:

$$\begin{aligned}\Delta M2_t = \beta_0 &+ \sum_{i=0}^{\rho} \phi_i \Delta M2_{t-i} + \sum_{i=0}^{\rho} \theta_i \Delta RM_{t-i} \\ &+ \sum_{i=1}^{\rho} \varphi_i \Delta CD_{t-i} + \sum_{i=1}^{\rho} \alpha_i \Delta RD_{t-i} \\ &+ \sum_{i=1}^{\rho} \beta_i \Delta ERD_{t-i} + \sum_{i=1}^{\rho} \gamma_i \Delta DR_{t-i} \\ &+ \sum_{i=1}^{\rho} \omega_i \Delta ER_{t-i} + \delta_1 M2_{t-1} \\ &+ \delta_2 RM_{t-1} + \delta_3 CD_{t-1} \\ &+ \delta_4 RD_{t-1} + \delta_5 ERD_{t-1} \\ &+ \delta_6 DR_{t-1} + \delta_7 ER_{t-1} + \varepsilon_t\end{aligned} \tag{13}$$

Where M2, RM, CD, RD, ERD, DR, and ER are natural logarithms of the Broad Money Supply, Reserve Money, Currency-Deposit Ratio, Reserve-Deposit Ratio, Excess Reserve-Deposit Ratio, Deposit Rate, and Exchange Rate, respectively. The highest number of lags is denoted by ρ, whereas Δ represents the first difference operator.

If co-integration exists in the first stage, the succeeding ARDL(a, b, c, d, e, f, g) of a long-term model is estimated in the second step:

$$\begin{aligned}M2_t = \beta_1 &+ \sum_{i=0}^{a} \phi_{1i} M2_{t-i} + \sum_{i=0}^{b} \theta_{1i} RM_{t-i} \\ &+ \sum_{i=1}^{c} \varphi_{1i} CD_{t-i} + \sum_{i=1}^{d} \alpha_{1i} RD_{t-i} \\ &+ \sum_{i=1}^{e} \beta_{1i} ERD_{t-i} + \sum_{i=1}^{f} \gamma_{1i} DR_{t-i} \\ &+ \sum_{i=1}^{g} \omega_{1i} ER_{t-i} + \varepsilon_{1t}\end{aligned} \tag{14}$$

Where the variables' optimal number of lags is represented by a, b, c, d, e, f, and g.

In the final phase, ECM can be constructed in the following way to build up the short-term

dynamics of the ARDL specification:

$$\begin{aligned}\Delta M2_t = \beta_2 &+ \sum_{i=0}^{\rho} \phi_{2i} \Delta M2_{t-i} + \sum_{i=0}^{\rho} \theta_{2i} \Delta RM_{t-i} \\ &+ \sum_{i=1}^{\rho} \varphi_{2i} \Delta CD_{t-i} + \sum_{i=1}^{\rho} \alpha_{2i} \Delta RD_{t-i} \\ &+ \sum_{i=1}^{\rho} \beta_{2i} \Delta ERD_{t-i} + \sum_{i=1}^{\rho} \gamma_{2i} \Delta DR_{t-i} \\ &+ \sum_{i=1}^{\rho} \omega_{2i} \Delta ER_{t-i} + \mu ECM_{t-1} + \varepsilon_{2t}.\end{aligned} \tag{15}$$

Where μECM_{t-1} is the error correction term, specified as:

$$\begin{aligned}ECM_t = M2_t - \beta_1 &- \sum_{i=0}^{a} \phi_{1i} M2_{t-i} \\ &- \sum_{i=0}^{b} \theta_{1i} RM_{t-i} - \sum_{i=1}^{c} \varphi_{1i} CD_{t-i} \\ &- \sum_{i=1}^{d} \alpha_{1i} RD_{t-i} - \sum_{i=1}^{e} \beta_{1i} ERD_{t-i} \\ &- \sum_{i=1}^{f} \gamma_{1i} DR_{t-i} - \sum_{i=1}^{g} \omega_{1i} ER_{t-i}.\end{aligned} \tag{16}$$

The short-term dynamics of the model's convergence to equilibrium are represented by all of the coefficients in equation (15), where μ is the speed of adjustment.

5 Results and Analyses

5.1 Stationarity of the Unit Root Test

To apply the ARDL approach, the stationarity and integration order of the time series must be established. The ARDL technique assumes that the time series are integrated at order I(0) or I(1), but not at order I(2). To verify the unit root, the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests are widely used to determine whether the time series data are stationary and integrated at the appropriate order. Table 3 presents the results of the unit root test.

Based on the results of the ADF and PP tests, the Currency-Deposit (CDR) Ratio, Reserve-Deposit (RDR) Ratio, and Excess Reserve-Deposit (ERDR) Ratio are stationary at I(0), while Broad Money (M2), Reserve Money (RM), Deposit Rate (DR), and Exchange Rate (ER) are stationary at I(1). Since the variables have a mixed order of integration, a combination of I(0) and I(1), the ARDL bounds testing method should be used to examine the impact of the explanatory variables on the dependent variable (Pesaran et al., 2001).

5.2 VAR Lag Order Selection Criterion

To detect the maximal lag for the ARDL model, the VAR model's lag length criteria are employed. The VAR lag order selection result is shown in Table 4.

Table 4: VAR Lag Order Selection Criteria

Lag	Log L	LR	FPE	AIC	SC	HQ
0	1113.152	NA	3.54e-12	-12.178	-12.089	-12.142
1	2708.471	3085.451	1.13e-19	-29.434	-28.906*	-29.220*
2	2736.473	52.619*	1.10e-19*	-29.467*	-28.498	-29.074
3	2750.703	25.958	1.24e-19	-29.348	-27.940	-28.778
4	2761.779	19.596	1.45e-19	-29.195	-27.347	-28.446

Note: * indicates lag order selected by the criterion. LR denotes the sequential modified LR test statistic, with each test conducted at the 5% level.
Source: Authors' own calculation using E-Views 13. Data source: Monthly Economic Trends (MET), Bangladesh Bank.

Based on the AIC, LR, and FPE criteria, the optimal lag order of 2 is selected for the ARDL model in this study. Since most criteria recommend a lag order of 2, the maximum lag order of 2 is applied to the ARDL model of M2 with the regressors (M2, RM, CDR, RDR, ERDR, DR, and ER).

5.3 ARDL Results

The ARDL model applies a maximum lag of 2 for all regressors after considering the criteria suggested by the VAR model. The findings reveal significant relationships between M2 and the regressors at different lags. M2 exhibits a positive and significant relationship with RM, while a negative relationship is observed with CDR, RDR, ERDR, and ER.

Table 3: Findings of the Unit Root Test

	ADF			PP		
Variable	**Level**	**1st Diff.**	**Decision**	**Level**	**1st Diff.**	**Decision**
M2	-2.1934	-4.3128***	I(1)	-7.4707***	-15.8283***	I(0)
RM	-1.7120	-26.0293***	I(1)	-1.9487	-4.0822***	I(1)
C-D Ratio	-3.5658***	-13.8353***	I(0)	-5.3405***	-32.6042***	I(0)
R-D Ratio	-2.8356**	-14.0338***	I(0)	-3.4189***	-23.0846***	I(0)
ER-D Ratio	-3.0324**	-15.9890***	I(0)	-5.3784***	-28.4282***	I(0)
DR	-1.0988	-6.2120***	I(1)	-1.3580	-10.9893***	I(1)
ER	-1.4715	-10.4402***	I(1)	-1.6191	-10.5862***	I(1)

Note: *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively. M2, RM, DR, and ER are in natural logarithm form.
Source: Authors' own calculation using EViews 13. Data source: Monthly Economic Trends (MET), Bangladesh Bank.

5.4 Results of ARDL Bound Tests for Co-integration

The ARDL bounds test is employed to examine the long-term relationship among the regressors. The results of the bounds test for co-integration are presented in Table 5.

Table 5: Bounds Test Result for Co-integration

F-Statistic = 8.141* **		
Significance	**Lower Bound I(0)**	**Upper Bound I(1)**
10%	2.49	3.38
5%	2.81	3.76
1%	3.50	4.63

Source: Authors' own calculation using EViews 13. Data source: Monthly Economic Trends (MET), Bangladesh Bank.

The calculated F-statistic (8.141) exceeds the upper bounds at the 10%, 5%, and 1% significance levels, as shown in Table 5. Consequently, the null hypothesis is rejected, confirming the presence of co-integration. These results indicate that the variables are co-integrated, establishing a long-run relationship between M2 and the model's regressors.

5.5 The Outcomes of Long-Run and Short-Run Dynamics

Since co-integration has been established, the next step is to assess the long-term and short-term dynamics of the model. The computed long-term and short-term coefficients are presented in Tables 6 and **??**, respectively.

Table 6: Estimated ARDL Long-Run Dynamics

Variable	**Coefficient**	**Std. Error**	**t-Statistic**
RM(-1)	0.6102	0.2036	3.0001***
CDR	-0.1514	0.4584	-0.3303
RDR	-1.6535	0.5698	-2.9021***
ERDR(-1)	-0.1791	0.5309	-0.3375
DR	-0.1718	0.0841	-2.0430**
ER(-1)	-0.3259	0.2300	-1.4172

Note: *** and ** indicate significance at 1% and 5% levels, respectively.
M2, RM, DR, and ER are in natural logarithm form.
Source: Authors' own calculation using E-Views 13. Data Source: Monthly Economic Trends (MET), Bangladesh Bank.

Therefore, the Error Correction Term (ECT) can be presented as follows:

$$\begin{aligned} ECT_{t-1} = {} & 1.00M2_{t-1} - 0.610RM_{t-1} \\ & + 0.151CDR_{t-1} + 1.654RDR_{t-1} \\ & + 0.179ERDR_{t-1} + 0.172DR_{t-1} \\ & + 0.326ER_{t-1} + 4.143 \end{aligned} \tag{17}$$

Equation (17) states that, as expected, RM has a positive and significant impact on M2, indicating that the regressor truly affects the money supply in Bangladesh in the long run. On average, a 1% increase in RM raises the money supply in Bangladesh by 0.610. On the other hand, an inverse relationship is observed between M2 and the reserve-deposit ratio (RDR), which is also significant at the 1% level. Specifically, a 1% increase in RDR reduces the money supply in Bangladesh by 1.65. Thus, these two factors are the key drivers of the money supply in Bangladesh.

The estimated elasticity of reserve money (RM) is 0.6102 and statistically significant. This implies that a 1% increase in RM leads to an approximately 0.61% rise in M2. Although the effect is positive and economically meaningful, the elasticity being less than unity suggests that changes in RM are only partially transmitted to M2, indicating a moderate money multiplier process, where the banking system amplifies base money, but not proportionately. Therefore, reserve money remains an important, though not overwhelmingly strong, driver for monetary expansion.

On the contrary, the estimated coefficient of the reserve-deposit ratio (RDR) is -1.65 and statistically significant. This implies that a one percentage point increase in RDR reduces M2 by approximately 1.65%. This magnitude is economically meaningful, indicating reserve behavior has a strong contractionary effect on money creation. In other words, it suggests reserve-related instruments remain a quantitatively powerful channel for monetary control in Bangladesh for the study period.

Additionally, the Currency-Deposit (CDR) Ratio, Reserve-Deposit (RDR) Ratio, Excess Reserve-Deposit (ERDR) Ratio, Deposit Rate (DR), and Exchange Rate (ER) also influence the money supply in the long run.

The empirical findings regarding the negative impact of the deposit rate and exchange rate on the money supply in Bangladesh reflect the intricate interplay between central bank policy, commercial banking behavior, and external sector dynamics. These results are consistent with the broader macroeconomic framework where the Bangladesh Bank regulates liquidity to maintain price stability and financial health.

The observed negative relationship between the deposit rate and the money supply (M2), with a long-run coefficient of -0.1718, suggests that higher interest rates on deposits incentivize a shift in public behavior toward increased savings. In the context of Bangladesh's interest rate transmission mechanism, an increase in the deposit rate often leads to a rise in the cost of funds for commercial banks, which subsequently raises lending rates. This process can curb private sector credit demand, thereby slowing down the money creation process through the banking system. Furthermore, the sources indicate that the deposit rate influences deposit behavior, where higher rates encourage individuals to hold more funds in time deposits rather than more liquid forms of money, which can affect the overall velocity and growth of the broad money supply.

Regarding the exchange rate, the empirical results show a negative impact on the money supply, indicating that as the Bangladeshi Taka (BDT) depreciates against the US Dollar (an increase in the ER variable), the money supply tends to contract. This finding is deeply rooted in Bangladesh's exchange rate management framework and the source-side components of M2, specifically Net Foreign Assets (NFA). When the BDT faces depreciation pressure, the Bangladesh Bank often intervenes by selling foreign exchange reserves to stabilize the currency. This intervention absorbs Taka liquidity from the domestic banking system, directly reducing the reserve money and, consequently, the broad money supply through the multiplier effect. Additionally, depreciation can lead to higher costs for imported goods, prompting the central bank to maintain a tighter monetary stance to mitigate inflationary pressures, which further restricts the growth of the money stock.

Collectively, these findings highlight that the money supply in Bangladesh is not only determined by the monetary base but is also significantly influenced by the behavioral responses of the public and banks to interest rate changes and the central bank's strategic interventions in the foreign exchange market.

5.6 Short-Run Dynamics and Error Correction Mechanism

As mentioned earlier, the short-run dynamics of the model describe the convergence path, i.e., how temporary shocks cause disequilibrium. The short-run dynamics of the ARDL model are presented in Table 7.

Table 7: Short-Run Dynamics and ECM for the Estimated ARDL Model

Variables	Coefficient	Std. Error	T-Statistic
D(RM)	0.2042	0.0118	17.1996***
D(RDR)	-0.1059	0.0415	-2.550***
D(ERDR)	-0.1080	0.0333	-3.2501***
D(ER)	0.0892	0.0435	2.0578**
COINTEQ*	-0.0641	0.0078	-8.2357***

*** and ** indicate significance at 1% and 5% levels, respectively.

M2, RM, DR, and ER are in natural logarithm form.

Source: Authors' own calculation in E-Views 13. Data Source: Monthly Economic Trends (MET) of BB.

The co-integrating and long-run equation can be written as follows:

$$\begin{aligned}\Delta \ln M2_t = {} & 0.532 - 0.610RM_{t-1} + 0.151CDR_{t-1} \\ & + 1.654RDR_{t-1} + 0.179ERDR_{t-1} \\ & + 0.172DR_{t-1} + 0.326ER_{t-1} + 4.143\end{aligned} \tag{18}$$

The most important component of the short-run dynamics is the error correction term, ECT_{t-1}, which is presented in Table 8.

Table 8: Error Correction Term

Error Correction Term	Coefficient	Std. Error	T-Statistic
ECT_{t-1}	-0.0641	0.0078	-8.2357***

*** indicates significance at 1% level.

Source: Authors' own calculation in E-Views 13. Data Source: Statistics Department of Bangladesh Bank (BB).

The coefficient of ECT_{t-1} is -0.0641, which has a negative sign, is less than 1 in absolute value, and is highly significant even at the 1% level. The negative sign indicates that the short-run dynamics move back to equilibrium. Moreover, the ECT coefficient value of -0.0641 signifies the speed of adjustment to equilibrium, meaning that the previous deviation from long-run equilibrium is corrected in the current period at a speed of 6.41%. These characteristics suggest a long-term relationship between M2 and the model's regressors.

5.7 Johansen Test of Cointegration

To confirm the presence of a long-run relationship among the variables of interest, the Johansen cointegration test is applied with 2 lags, and

The results of the trace test and max-eigenvalue test indicate that there are at least 4 and 2 co-integrating equations, respectively, found at the 0.05 level (Tables 9 and 10 in the Appendix). This means that the null hypothesis of no co-integration is rejected, and co-integration exists between M2 and the model's regressors. From the Johansen normalization interpretation, it is evident that RM has a positive impact and RDR has an inverse impact on M2 (since the signs are reversed in the long run), and both are statistically significant at the 1% level, which also supports the findings of the ARDL model. Therefore, it can be concluded that there is a long-run relationship between the money supply and the model's regressors.

Table 9: Johansen Normalization Interpretation

Cointegrating Equation Log-Likelihood: 3881.674							
Normalized Cointegrating Coefficients (Standard Error in Parentheses)							
	M2	**RM**	**C-D Ratio**	**R-D Ratio**	**ER-D Ratio**	**DR**	**ER**
Coefficient	1.000	-1.0667	3.38039	4.7879	-0.4761	-0.1258	0.1390
Std. Error		(0.0358)	(0.3784)	(0.44584)	(0.3150)	(0.0519)	(0.08517)

Adjustment Coefficients (Standard Error in Parentheses)		
Variable	**Coefficient**	**Std. Error**
D(M2)	-0.0004898	(0.01974)
D(RM)	0.0189	(0.07667)
D(C-D Ratio)	-0.17194	(0.02849)
D(R-D Ratio)	-0.0979	(0.01787)
D(ER-D Ratio)	-0.06806	(0.02274)
D(DR)	0.027025	(0.0333212)
D(ER)	0.006577	(0.01984)

Source: Author's own calculation in EViews 13.
Note: M2, RM, DR, and ER are in natural logarithm form. Data source: Statistics Department of Bangladesh Bank (BB).

The use of both the ARDL bounds testing approach and the Johansen cointegration test in this study is intended to strengthen the robustness and reliability of the empirical findings rather than to create redundancy. The ARDL bounds testing method is primarily used to determine the existence of long-run and short-run relationships among variables and serves as the main estimation technique to analyze the dynamic relationships between money supply and its determinants.

The Johansen cointegration test is employed as an additional robustness check to confirm the existence of long-run relationships identified by the ARDL model. Since the Johansen technique is based on a multivariate framework and requires variables to be integrated at the same order, it provides complementary evidence regarding the co-integration among the variables. The consistency of results obtained from both methods strengthens confidence in the stability and validity of the long-run relationships between money supply and its determinants in Bangladesh.

5.8 ARDL Model Fitness Checking

To examine the robustness and adequacy of our estimation, we employed the normality test, serial correlation analysis, and the heteroscedasticity test. Table 10 outlines the results of the diagnostic tests for the estimated model.

Based on the outcomes of the F-statistics with high p-values, the calculated model successfully passes diagnostic tests for residual serial correlation, heteroscedasticity, and non-normality. Thus, we can infer that our model is a good fit, as it meets all diagnostic criteria. Moreover, the study's long-run and short-run inferences are robust, as the tests indicate that the regression coefficients remain relatively constant throughout the sample period. This is evidenced by the blue line remaining within the two red bands at the 5% significance level, as shown in Figures 3 and 4.

Thus, the diagnostic tests of the model successfully satisfy all the basic properties of the

ARDL model, including the absence of autocorrelation, homoscedasticity, normal distribution, and the stability of the regression coefficients, as confirmed by the CUSUM and CUSUMSQ tests, which were briefly explained in the methodology section.

Table 10: Diagnostic Test Results

Diagnosis	Test Statistic (F)	P-value
Breusch-Godfrey Serial Correlation LM Test	0.0187	0.9814
Breusch-Pagan-Godfrey Heteroscedasticity Test	1.0945	0.3604
Normality (Jarque-Bera) Test	0.0402	0.9801

Source: Authors' own calculation in E-Views 13.

Data Source: Statistics Department of Bangladesh Bank (BB).

6 Conclusion, Policy Implications, and Directions for Future Research

This study explores the key determinants of Bangladesh's money supply from FY2009 to FY2024 by utilizing the ARDL technique. The analysis shows that all of the variables are co-integrated, implying a long-term relationship between Bangladesh's money supply and the model's regressors. The findings indicate that the reserve-deposit ratio has a significant contractionary effect, whereas reserve money has a positive but less-than-proportional impact on the money supply in Bangladesh over the study period. In particular, a 1% increase in reserve money results in a nearly 0.61% increase in the money supply, whereas a one percentage point increase in the reserve-deposit ratio reduces the money supply by 1.65%. As a result, this implies that reserve requirement modifications and cautious monetary base management remain effective instruments for regulating Bangladesh's money supply. The empirical findings help to understand the transmission processes underlying monetary control in Bangladesh and have significant policy implications for the monetary authority in maintaining macroeconomic stability in Bangladesh.

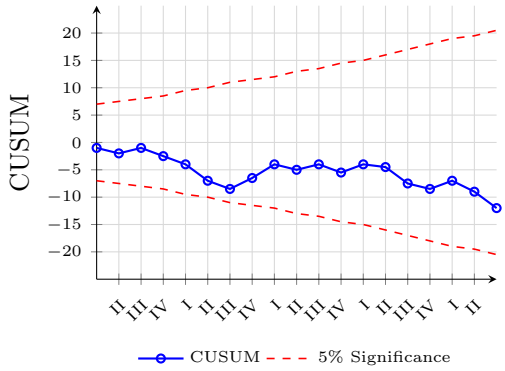

Figure 3: CUSUM Test for Model Stability
Source: Authors' calculation using EViews 13.

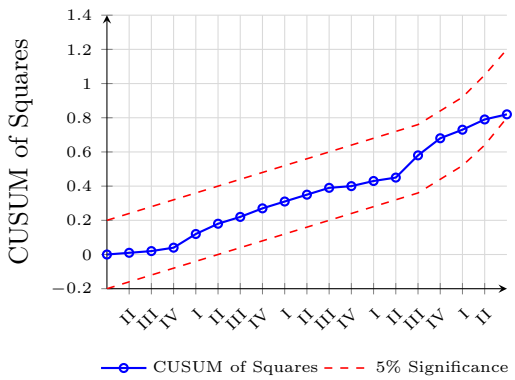

Figure 4: CUSUM of Squares Test for Model Stability
Source: Authors' calculation using EViews 13.

In instrument-wise policy terms, the reserve-deposit ratio's significant contractionary effect indicates that reserve-based instruments remain a viable method for regulating the money supply. While facing inflationary pressures, targeted increases in reserve requirements could create meaningful liquidity contraction. However, the positive but less-than-

unitary elasticity of reserve money suggests that open market operations continue to have an impact on money expansion, albeit with a moderate transmission. Furthermore, improving liquidity forecasting methods and coordination between reserve management and market-based operations will increase the effectiveness of monetary regulation. Overall, the results highlight the continued relevance of reserve management and liquidity operations in shaping the operational strategy of Bangladesh Bank.

This study uses rigorous econometric tools to analyze the determinants of Bangladesh's money supply, but there is significant room for future research to include additional variables, alternative model specifications, and higher-frequency data to improve robustness and policy relevance. Looking forward, future study could look into different econometric methodologies, such as structural vector autoregression (SVAR), nonlinear models, or time-varying parameter frameworks, to better capture complex monetary transmission dynamics.

Second, higher-frequency data (e.g., daily or fortnightly observations) may provide more insight into short-run liquidity adjustments, while a broader time range may improve the model's resilience. Third, breaking down monetary aggregates into sectoral credit components could reveal which industries fuel monetary growth. Finally, incorporating Shariah-based financial indicators such as Islamic banking deposit share or Islamic financing-to-GDP ratio may capture the fundamental dynamics of Bangladesh's dual banking system.

Disclosure Statement

Views expressed in this paper are the authors' own and do not necessarily reflect the views of institutions they are affiliated with.

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