International Journal of Social Science, Management and Economics Research
Volume 2 Issue 2 March-April 2024
ISSN: 2583-9853| www.ijssmer.com

RELATIONSHIP BETWEEN RESERVE MONEY AND ECONOMIC GROWTH IN BANGLADESH: AN EMPIRICAL ANALYSIS USING THE AUTOREGRESSIVE DISTRIBUTED LAG (ARDL) APPROACH

Md. Alamin
Assistant Director, Research Department, Bangladesh Bank Dhaka, **Bangladesh**

DOI - https://doi.org/10.61421/IJSSMER.2024.2202

ABSTRACT

This study uses the Autoregressive Distributed Lag (ARDL) method to examine the relationship between reserve money and economic growth in Bangladesh. The analysis aims to provide insights into the dynamics between reserve money and Gross Domestic Product (GDP) and to evaluate the efficiency of monetary policy in stimulating economic activity. The research employs time series data spanning the years 1991–2021 from the Major Economic Trends of Bangladesh Bank. The study considers GDP as proxy of economic growth, which is dependent variable and Reserve Money as proxy of money supply, which is independent variable. The ARDL model is utilized to estimate the short-term and long-term relationships between reserve money and GDP, while diagnostic tests are conducted to ensure the robustness of the model. Co-integration analysis is performed to examine the existence of a long-term equilibrium relationship between the variables. The findings reveal significant insights into the relationship between reserve money and economic growth in Bangladesh. The study highlights the positive impact of reserve money on GDP, emphasizing the role of monetary policy in stimulating economic activity. Moreover, the analysis underscores the importance of maintaining stability in the monetary system to foster sustainable economic growth. The findings offer guidance for formulating effective monetary policies aimed at promoting economic growth and stability in the country.

Keywords: Reserve Money, Economic Growth, Autoregressive Distributed Lag (ARDL), Monetary Policy, Gross Domestic Product (GDP).

1. INTRODUCTION

Reserve money is the total amount of a nation's currency that is either in circulation or kept in the reserves of the central bank. It's also known as high-powered money or base money. Reserve money is a crucial component of the money supply in an economy and is necessary for the implementation of monetary policy. Central banks utilize adjustments to reserve money as a tool to influence the money supply and, consequently, the status of the economy. Central banks have the capacity to manage the expansion of reserve money and, consequently, impact inflation, interest rates, and general economic stability through the manipulation of interest rates, open market operations, and reserve requirements.

The way in which the money multiplier and reserve money (RM) interact is crucial in determining the money supply, a topic that is extensively discussed and examined in economics. This fundamental premise relies on the stability of the money multiplier and the central bank's effectiveness in managing reserve money. The intricate dynamics involving central banks, financial institutions such as banks and non-banks, and the general public collectively influence the money supply. In light of this comprehension, the central bank's responsibility encompasses overseeing reserve money, thus influencing the broader money supply (Bangladesh Bank, 2023).

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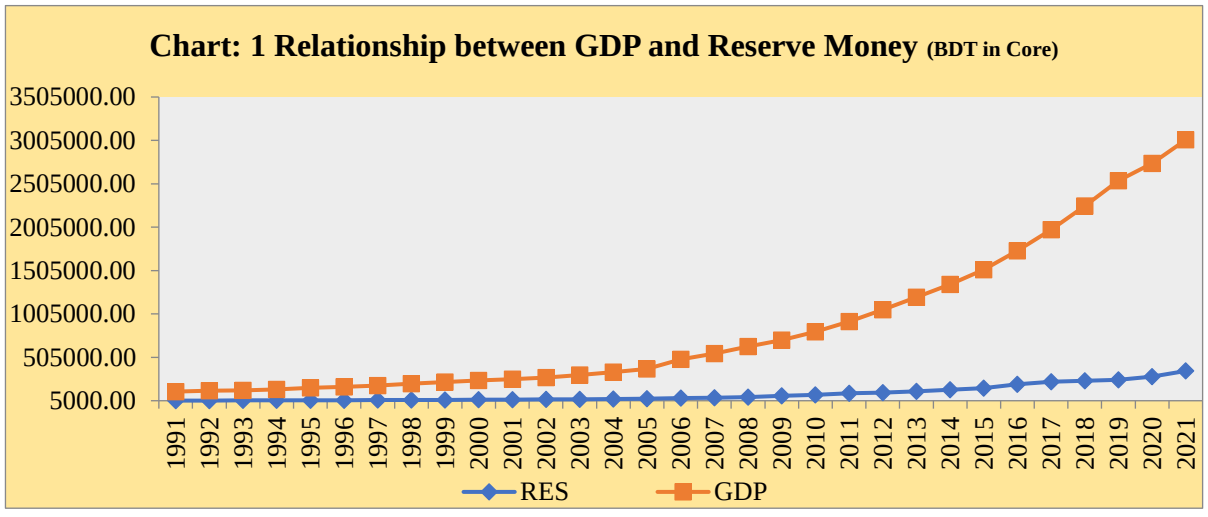
The relationship between Money Supply (M2) and Reserve Money (RM) is briefly described by the equation: M2=mm×RM (1). Here, M2 represents the total money supply, mm denotes the money multiplier, and RM stands for reserve money. The money multiplier encapsulates the potential of reserve money to stimulate the extension of the money supply. Thus, any change in money supply (ΔM2) resulting from changes in reserve money (ΔRM) fundamentally hinges on the stability of the money multiplier (mm). The stability of the money multiplier (mm) determines the central bank's ability to control the money supply (M2) through changes in RM. This stability is affected by diverse aspects, including consumer behaviors, the resilience of the banking system (as illustrated by the transmission mechanism), prevailing inflation trends, and the monetary policy stance adopted by the central bank.

Reserve money, representing the base of the monetary pyramid, constitutes a fundamental component of a nation's monetary system. It affects the entire monetary and financial system, including money in circulation and reserves held by commercial banks with the central bank. Meanwhile, economic growth epitomizes the overarching goal of nations aspiring towards prosperity, encompassing multifaceted dimensions of productivity, investment, and consumption dynamics.

Knowing the relationship between reserve money and economic growth is crucial when it comes to Bangladesh, a nation known for its dynamic financial system and dynamic economic environment. The effectiveness of monetary policy, the stability of financial markets, and the sustainability of economic expansion are all intricately linked to the dynamics of reserve money and its impact on the broader economy.

The utilization of the Autoregressive Distributed Lag (ARDL) technique is demonstrated to be a resilient methodology in examining the relationship between reserve money and economic growth, both in the short and long term. Through the consideration of both the short-term oscillations and the long-term equilibrium relationship among the variables, the ARDL approach provides valuable insights into the intricate dynamics influencing the monetary transmission mechanism and economic outcomes.

An important area of research is the relationship between reserve money and economic growth, especially in the context of developing nations like Bangladesh. As a nation characterized by dynamic economic forces and striving for sustained development, Bangladesh offers a compelling backdrop for exploring the intricate interplay between monetary aggregates and overall economic performance. This empirical analysis aims to delve into the nuanced dynamics between reserve money and economic growth in Bangladesh, employing the Autoregressive Distributed Lag (ARDL) approach as the analytical framework.



Source: Monthly Economic Trends, Bangladesh Bank.

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Chart 1 illustrates the correlation between reserve money and GDP in Bangladesh from 1991 to 2021. The data suggests a positive association between Bangladesh's GDP and the level of reserve money.

2. LITERATURE REVIEW

The reserve money generated contributes to the money supply in the market, thereby influencing inflation, which in turn impacts nominal GDP. Numerous articles have delved into the correlation between reserve money, money supply and GDP. This study reviews the article relating to reserve money, money supply and economic growth, shedding light on their interconnectedness.

The relationship between the M1 money supply, total reserves held by banks, and real GDP in the US is examined by Hartman, H. C. (2012). The Johansen method of cointegration testing is employed in the study to address this query. The findings show that the variables show cointegration at the five percent significance level for the sample period. Additionally, the study shows cointegration for a portion of the period ending in 2008 between the US real GDP, M1, and monetary base. It is noted that circumstances surrounding the most recent financial crisis may have caused the cointegration between the natural logarithms of the US real GDP and M1, the total reserves, to collapse.

Real M1, real net national product, and the commercial paper rate have a steady, long-term association, according to Stock, J. H., & Watson, M. W. (1993), the researchers examined annual data from 1900 to 1989. They discover that differences in the cointegrating vector estimates between pre- and post-war periods point to a possible change in the long-term relationship between money demand and supply.

Marshal, I. (2016) looks into the connection between Nigeria's economic expansion and the amount of money in circulation. The researcher uses VAR and cointegration models inside a basic regression framework. The study found that Nigeria's actual gross domestic product and its money supply (as determined by M2) had positive and strong long-term associations.

Arfanuzzaman, M. (2014) looked into the long-term relationship between Bangladesh's money supply and economic growth rate from 1974 to 1989. The results show a strong long-term correlation between GDP growth rate and money supply. Additionally, the findings point to a causal connection between GDP and the total money supply.

Rahman, M. J., & Qayum, M. A. (2013) use the King and Watson testing approach, which is based on a two-variable structural vector autoregression (SVAR) model, to investigate the long-term neutrality of money in the Bangladeshi economy. Data spanning from 1974 to 2008 is examined. The analysis offers support for the long-term neutrality of M2. However, similar evidence of M1 neutrality is not discovered in the case of Bangladesh.

In Sudan, from 1960 to 2005, Ahmed, A. E. M., & Suliman, S. Z. (2011) examined the relationship between GDP, money supply, and inflation. They applied the Granger causality test and co-integration analysis. The three series have a long-term association, according to co-integration testing. By employing the Granger causality framework, they found that the money supply and prices are primarily causally related.

Ogunmuyiwa, M. S., and Ekone, A. F. (2010) examined the relationship between Nigeria's money supply and economic growth from 1980 to 2006. According to their econometric research, Nigeria's GDP benefits somewhat from the real per capita interest rate. Nevertheless, these conclusions were not corroborated by the error correction model (ECM) results. The ECM results demonstrate that

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the money supply growth rate is not a reliable indicator of actual GDP growth in the near future. Additionally, investigations looking for long-term causal links between the two variables produced no statistically significant results.

Muhammadpour et al. (2012) examine the relationship between Malaysia's GDP and monetary policy using quarterly data from 1991 to 2011. They show a clear long-term equilibrium relationship between real GDP and the monetary aggregates M1, M2, M3, and the real interest rate using co-integration analysis and Vector Error Correction Models (VECM). The VECM analysis emphasizes the statistical relevance of the monetary supply variables, M1, M2, and M3, as well as their long-term effects on GDP. The study's conclusions imply that an increase in the money supply will probably cause the real GDP of the Malaysian economy to rise.

Hameed, I. (2010) investigated the relationship between GDP and money supply in Pakistan between 1980 and 2009. According to their findings, an economy's GDP is greatly impacted by the expansion of its money supply, whereas the interest rate has little bearing on GDP.

3. OBJECTIVE OF THE STUDY

The goal of the research is to use the Autoregressive Distributed Lag (ARDL) approach to examine the relationship between reserve money and economic growth in Bangladesh from 1991 to 2021.

4. DATA AND METHODOLOGY

GDP, a stand-in for economic growth, is the dependent variable in this study, while reserve money, a stand-in for the money supply, is the independent variable. Utilizing information from Bangladesh Bank's Major Economic Trends, the analysis seeks to determine how reserve money and GDP in Bangladesh relate to each other between 1991 and 2021. The study incorporates annual data on GDP at current prices and reserve money, encompassing Currency outside Banks, Currency in Tills of Deposit Money Banks (DMBs), and Deposits with Bangladesh Bank.

5. MODEL SPECIFICATION

Using the ARDL model, the research investigates the effect of reserve money on GDP.

The empirical model can be shown as,

GDP =F (Res).

Where,

GDP = Gross Domestic product

Res= Reserve Money

The aforementioned equations' logarithmic form is:

$\mathrm{INGDP} = \alpha_{\circ} + \alpha_1 \mathrm{INRes} + \varepsilon_t$ ---------- 1.

Where, INGDP and INRes refers to the series logarithmic ε_t is the error term and $\alpha_{\circ}, \alpha_1$ are the betas of parameters under study.

ARDL Model:

The long- and short-term ARDL strategies are presented below.

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$$\Delta INGDP = \alpha_0 + \sum_{j=1}^{n} bj\Delta INGDP_{t-j} + \sum_{j=1}^{n} cj\Delta INRES_{t-j} + \delta_1 INGDP_{t-1} + \delta_2 INRES_{t-1} + \epsilon_{1t}\text{----------2}$$

The underlying ARDL model's short-run dynamic coefficients are represented by the b, c parameters, and its long-run multipliers are represented by the δ1, δ2 parameters.

6. ANALYSIS OF THE ESTIMATED RESULTS

6.1 Unit root test:

Table 1 displays the findings of the unit root tests for Phillips-Perron (PP) and Augmented Dickey-Fuller (ADF) that were conducted to assess the stationary nature of the variables in both their levels and initial differences.

Table -1	**ADF tests**		
"Variable"	"At Level"	"At First Difference"	"Decision"
lnGDP	-2.37	-3.75**	I (1)
lnRES	-1.66	-4.23**	I (1)
PP tests			
"Variable"	At Level:	At First Difference:	Decision:
lnGDP	-2.28	-3.75**	I (1)
lnRES	-1.60	-4.12**	I (1)
Note: ** indicate significant at 5% level. **Source:** Author's own calculation using EViews.			

The ADF test results suggest that the GDP and Reserve Money series are stationary at the I (1) level, as indicated in the reported findings. Similarly, the Phillips–Perron (PP) test also confirms the stationarity of GDP and Reserve Money at the I (1) level. The ARDL limits test is advised for time series that show stationarity at either I (0) or I (1), per Pesaran et al. (2001). Therefore, in this case, we can use the ARDL bound test for cointegration analysis.

6.2 ARDL bound test to Co integration

To determine whether there are any long-term links between variables, the ARDL bounds test is utilized. Table 2 presents the results of the bounds test for co-integration, indicating whether such relationships exist between the variables under consideration.

Table-2: "Bound F test for cointegration"

F-statistic= 5.100130		
"Level of Significance"	I (0)	I (1)
10%	3.02	3.51
5%	3.62	4.16
2.5%	4.18	4.79
1%	4.94	5.58

Source: Author's own calculation using EViews.

The computed F-statistic (5.10) surpasses the critical values at the significance levels of 5%, 2.25%, and 10%, according to Table 2. The existence of co-integration is thus confirmed since the null hypothesis, which proposed that there is no co-integration, is rejected. These findings imply that the variables show co-integration, suggesting a sustained connection between GDP and reserve money.

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6.3 Estimation of the Long Run Relationship

The computed model's long-run coefficients are shown in Table 3. The table indicates that reserve money and GDP have a significant and positive relationship.

Table-3: "Long run results"

"Variable"	"Coefficient"	"Std. Error"	"t-Statistic"	"Prob."
RES	0.879961	0.047375	18.57445	0.0000
C	4.080010	0.381329	10.69944	0.0000

Source: Author's own calculation using EViews.

At 0.88, the RES coefficient has a positive sign. This means that over the long term, there is a statistically significant association between a 1% increase in reserve money and a 0.88% increase in GDP. In practical terms, this suggests that reserve money, as part of the money multiplier process influencing money supply, has a consequential impact on GDP over time.

6.4 Short Run Result

The following Table 4 represents the short run Result of the estimated ARDL model:

Table-4: "Short run results"

"Variable"	"Coefficient"	"Std. Error"	"t-Statistic"	"Prob."
D(GDP(-1))	0.399823	0.143020	2.795579	0.0098
CointEq(-1)*	-0.161574	0.039747	-4.065024	0.0004

Source: Author's own calculation using EViews.

Based on the findings above, it is evident that the lagged value of GDP significantly and positively influences GDP itself. The error correction term (CointEq*) displays a negative sign, is less than 1, and remains highly significant even at the 1% level. These characteristics suggest a sustained long-term relationship between GDP and the model's predictors.

Moreover, the ECT coefficient value of -0.161574 indicates the pace at which the economy adjusts towards equilibrium. This implies that the economy corrects any disequilibrium and converges towards equilibrium at a rate of 16% annually. Thus, it can be said that reserve money has a significant and favourable effect on GDP over the long and short durations.

6.5 Diagnostics Test

Table 5 presents the results of the diagnostic tests used to evaluate the model's goodness of fit. The high probability values found in the F-statistics tests demonstrate that the computed model effectively passes diagnostic tests for heteroscedasticity and residual serial correlation (LM test). Consequently, we can infer that our model aligns well with the data since it meets the requirements set forth by the diagnostic tests.

Table 5. "Short -run diagnostic test"		
"Diagnostic Test"	"F-statistics"	"p-value"
"Serial Correlation LM test"	0.261745	0.7720
"Heteroskedasticity test"	0.170411	0.9154

Source: Author's own calculation using Eviews.

6.6 Stability Test

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Chart 2 displays the cumulative sum (CUSUM) and cumulative sum of squares (CUSUMSQ) in order to assess the model's stability. In both graphs, the residuals of the estimated line fall within the bounds of the upper and lower lines, indicating that the estimated model remains stable.

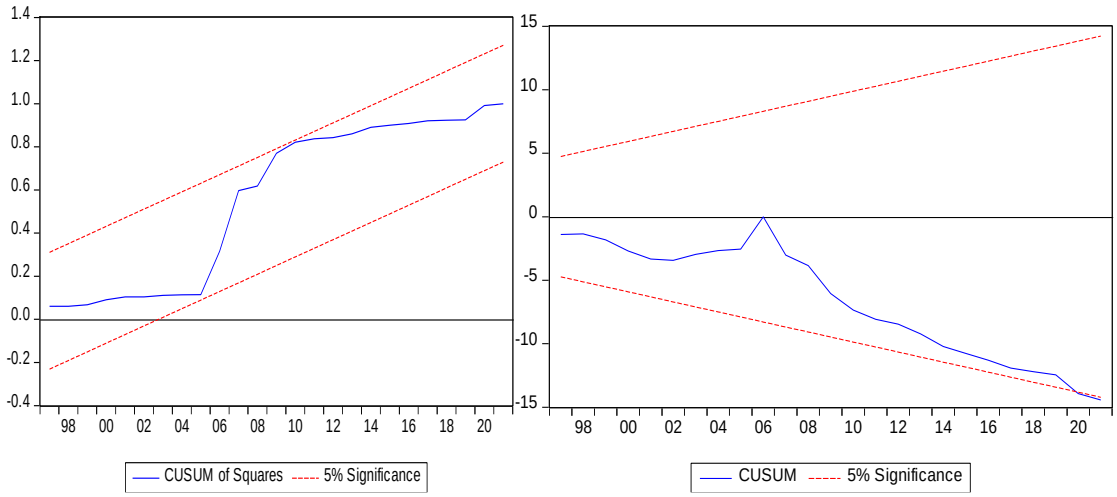

Chart 2 CUSUM and CUSUMSQ test.

7. CONCLUSION

This study examined how reserve money and economic growth in Bangladesh were related using the Autoregressive Distributed Lag (ARDL) technique. The empirical analysis yielded several significant findings that shed light on the dynamics between these variables.

First, the ARDL limits test provides strong evidence that reserve money and economic growth in Bangladesh are co-integrated. This implies that there is a long-term relationship between the two variables and that changes to reserve money may have an impact on economic growth in the long run.

The calculated coefficients from ARDL model provided further insights into the nature of this relationship. The positive coefficient associated with reserve money indicates that increases in the money supply positively influence economic growth in Bangladesh. Specifically, a 1% increase in reserve money is linked to a 0.88% increase in economic growth, according to the long-run coefficient.

The error correcting mechanism also brought attention to how quickly the economy corrects deviations from its long-term equilibrium path. A stable and self-correcting system is shown by the statistically significant and negative error correction term, which implies that the Bangladeshi economy converges towards its long-run equilibrium after brief disruptions.

The study's overall conclusions highlight the significance of reserve money management and monetary policy in fostering Bangladesh's economic expansion. Policymakers should pay close attention to the dynamics between reserve money and economic performance, recognizing the potential long-term effects of monetary interventions on the economy.

It is imperative to acknowledge the limits of this research, which encompass restrictions on data, specifications of the model, and extraneous variables that could impact the correlation between reserve money and economic growth. Subsequent investigations may investigate supplementary

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variables and utilize more advanced techniques to provide a deeper understanding of this correlation.

In conclusion, the empirical analysis using the ARDL approach provides valuable insights into the connection between reserve money and economic growth in Bangladesh, offering policymakers and researchers a better understanding of the mechanisms driving economic performance in the country.

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