

An Econometric Examination of the Money Supply Process in Bangladesh

Sabiha Akter^{1,*}

¹Master of Science (MSc) in Economics, Bangladesh University of Business and Technology

Abstract: This study offers a comprehensive econometric assessment of the money supply mechanism in Bangladesh, focusing on the dynamic relationships among the monetary base (H), the money multiplier (m), and the monetary aggregates (M1 and M2). The primary objective is to evaluate how effectively this process contributes to macroeconomic stability. Utilizing time-series data from 2004 to 2024, various econometric techniques are employed, including tests for stationarity, Johansen cointegration, Error Correction Models (ECM), and analysis of structural breaks. The findings demonstrate a stable long-term equilibrium among the variables, with both H and m exhibiting significant positive impacts on the money supply; however, the effect of the multiplier is slightly greater. Noteworthy short-term fluctuations were observed, particularly a structural break associated with the COVID-19 pandemic, which led to substantial deviations. Diagnostic assessments revealed severe multicollinearity and autocorrelation issues, addressed through Principal Component Analysis (PCA) and Newey-West HAC standard errors to ensure reliable conclusions. The study concludes that while the Bangladesh Bank effectively manages long-term money supply, it encounters challenges with short-term variations. Policy recommendations aim to enhance the efficiency of the banking sector to stabilize the money multiplier, employing an ECM framework for dynamic policy adjustments, and tailoring policy analyses to account for post-pandemic structural changes.

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*Address correspondence to this author at the Master of Science (MSc) in Economics, Bangladesh University of Business and Technology; Cell: +88 01727734829; E-mail: nishisabiha80@gmail.com

1. INTRODUCTION

A clear understanding of the money supply process is vital for effective macroeconomic management, as it significantly influences price stability, economic growth, and the resilience of the financial system. In developing nations like Bangladesh, which have undergone rapid structural and financial transformations over the past two decades, comprehending this process is essential. The Bangladesh Bank (BB), the country's central bank, utilizes various policy tools to manage liquidity and regulate monetary aggregates. However, this framework continuously faces challenges from domestic structural changes and external factors, such as global financial crises and pandemics. Deryugina (2025) explains that when the Fed increases the money supply, it generally lowers interest rates and boosts spending and a decrease in the money supply makes borrowing costlier, leading to reduced spending. This process influences short-term interest rates: higher reserves lead to lower rates, while fewer reserves result in higher rates. Other tools, such as changing reserve requirements and quantitative easing, are also employed by the Fed, but open market operations remain the primary method for stabilizing price growth (Deryugina, 2025).

Ali and Islam (2010) described that that high-powered money significantly impacts Bangladesh's money supply, particularly the narrow money supply (M1), which supports the monetarist model. The authors noted that variables related to Keynesian and structuralist analyses, including the bank rate, external resources, and financial liberalization, should be considered when analyzing the money supply process in Bangladesh. These variables also influenced the broad money supply. The authors cautioned that the estimated results should be interpreted carefully due to the poor performance of the narrow money model and the presence of multicollinearity in both the narrow and broad money (Ali and Islam, 2010). Sultana (2023) depicted that the consequences reveal a positive and significant impact on GDP from broad money supply, interest rates, inflation, and the exchange rate. The study attributes the positive effect of money supply to its deployment within a context of stable inflation, supporting the country's sustained growth above 6%.

Despite experiencing consistent economic growth, Bangladesh struggles with enduring issues like inflation and liquidity volatility, raising concerns regarding the reliability and efficiency of its money supply system. Central to this system is the equation: Money Supply = Monetary Base (H) × Money Multiplier (m). While theoretically sound, this relationship's

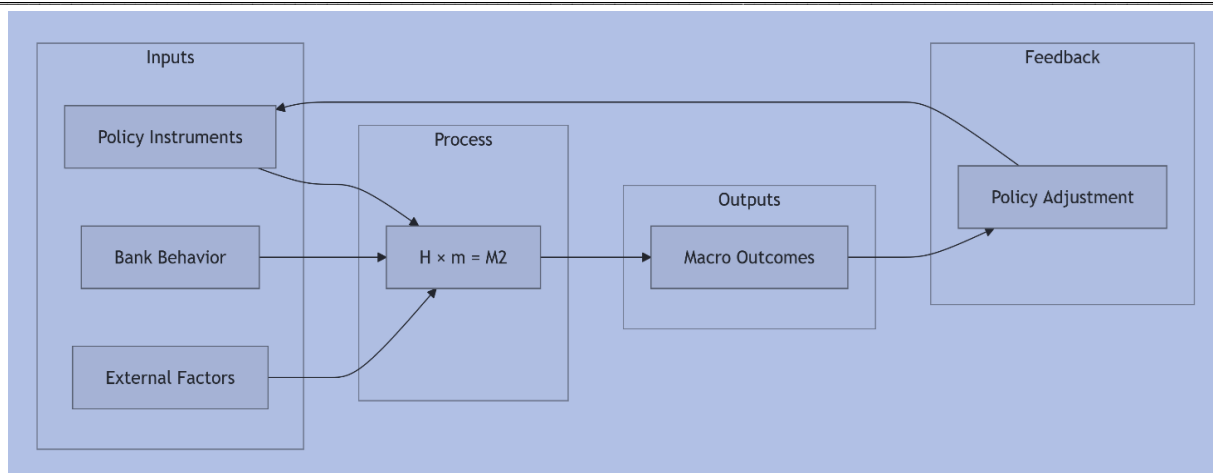


Fig. (1). shows Money supply determination process: (Source: Author).

empirical verification and practical relevance within Bangladesh’s distinct context warrants thorough examination. Existing literature is often fragmented, lacking a comprehensive and contemporary econometric approach that accommodates recent structural changes and data complexities.

This study aims to fill this critical gap by providing an in-depth and cohesive analysis of the components of the money supply in Bangladesh. It not only tests the foundational monetary identity but also investigates short-term dynamics and the impact of major economic disruptions. The research focuses on two primary questions:

- How do high-powered money (H) and the money multiplier (m) differently affect narrow (M1) and broad (M2) money supply in Bangladesh?
- What long-term equilibrium relationships and structural breaks characterize the interactions between these variables from 2004 to 2024?

1.1. Objectives of the Study

This study aims to address a significant research gap by offering a detailed analysis of Bangladesh's money supply components. Specific objectives include:

- **Differentiating Effects:** Explore the distinct impacts of high-powered money (H) and the money multiplier (m) on narrow (M1) and broad money (M2) supply in Bangladesh, clarifying their interactions and influences on overall money supply dynamics.
- **Identifying Long-Run Equilibria:** Investigate the long-term equilibrium relationships among high-powered money, the money multiplier, and various measures of money supply (M1 and M2) from 2004 to 2024, assessing the stability of these relationships over time.
- **Exploring Structural Breaks:** Analyze structural shifts affecting interactions between high-powered money, the money multiplier, and

money supply components during the study period, particularly focusing on significant economic events like the COVID-19 pandemic.

- **Testing the Monetary Identity:** Thoroughly evaluate the fundamental monetary identity within Bangladesh's economy, ensuring an in-depth analysis of both long-term trends and short-term fluctuations.
- **Formulating Policy Recommendations:** Develop actionable insights and policy recommendations based on findings, aimed at enhancing the effectiveness of monetary policy in managing the money supply and addressing economic challenges in Bangladesh.

By achieving these objectives, this study aspires to enhance understanding of Bangladesh's monetary framework and provide valuable guidance for policymakers in formulating effective monetary management strategies. The ultimate goal is to assess the efficiency of the money supply process.

1.2. Significance of the Study

This research is significant for multiple stakeholders. For policymakers, it provides actionable insights for refining monetary controls. For scholars, it represents a modern application of advanced time-series econometrics within a developing country context. For the broader economy, a stable money supply process is crucial for sustainable growth and poverty alleviation. The scope includes an analysis of monthly and quarterly data from 2004 to 2024, focusing on variables H, m, M1, and M2. While extensive, the analysis acknowledges limitations, such as difficulties in isolating the effects of all external shocks and inherent assumptions linked to econometric modeling, discussed in detail in the methodology section.

1.3. Plan of the Study: Brief Discussion

This study aims to conduct a comprehensive econometric analysis of the money supply process in Bangladesh from

2004 to 2024. The structured plan is designed to address identified gaps in the literature and to answer pivotal research questions.

The investigation concentrates on the fundamental monetary identity:

Money Supply (M1/M2) = Monetary Base (H) × Money Multiplier (m)

The study seeks to empirically verify how both H and m influence the money supply within Bangladesh's unique economic environment, which has experienced significant structural changes and external shocks.

The methodology will provide a robust framework through a multi-phase, quantitative approach using advanced time-series econometrics. Key elements include:

- **Data & Variables:** Utilization of high-frequency (monthly/quarterly) data for M1, M2, H, and m sourced from authoritative institutions such as Bangladesh Bank and the IMF.
- **Modeling Strategy:** A structured process involving:
 - Testing for stationarity using the ADF test.
 - Identifying long-run relationships through Johansen cointegration.
 - Modeling both long-term and short-term dynamics with an Error Correction Model.

Addressing Econometric Challenges:

The plan considers multicollinearity (employing Principal Component Analysis - PCA), autocorrelation (using Newey-West standard errors), and structural breaks (utilizing Chow Test and dummy variables).

- **Differentiating Effects:** The study will separate and quantify the distinct impacts of the central bank-controlled monetary base (H) and the market-influenced money multiplier (m) on both narrow (M1) and broad (M2) money.
- **Identifying Structural Changes:** A significant component of the analysis will test for and incorporate economic disruptions like the COVID-19 pandemic, examining if they constituted structural breaks in the money supply process.
- **Testing the Identity:** The research will rigorously validate the foundational monetary identity in the context of a developing economy.

The study aims to produce actionable policy recommendations. By clarifying the roles of H and m, alongside understanding the system's adjustment speed and its vulnerability to shocks, the findings are intended to assist Bangladesh Bank in formulating effective monetary policy. This includes strategies for managing inflation, ensuring liquidity, and promoting financial stability.

In summary, the study plan is a well-structured and methodologically sound roadmap designed to elucidate the dynamics of money supply in Bangladesh. This research bridges will

critical gaps in existing literature and offers evidence-based insights for effective policymaking.

2. LITERATURE REVIEW

Research on money supply determination is categorized into theoretical and empirical perspectives, each presenting differing views on managing monetary aggregates. The monetarist perspective, articulated by Friedman and Schwartz (1963), argues that the money supply is determined externally by the central bank's control over the monetary base (H), with the money multiplier (m) remaining stable and predictable. This perspective positions the central bank as a principal architect of monetary policy.

Conversely, post-Keynesian and endogenous money economists, such as Kaldor (1970) and Tobin (1965), argue that, in a modern credit economy, the money supply is primarily influenced by the demand for bank loans. In this view, the central bank mainly sets interest rates on reserves while the total money supply adjusts to facilitate economic activity, rendering the multiplier unstable.

Empirical studies from developing nations reflect these theoretical tensions. For instance, Sanusi (2010) noted a transition in Ghana's money supply from being influenced by fiscal deficits to foreign asset inflows. Similarly, in Indonesia, Wardhono (2022) found that fintech innovations are reshaping traditional cash-holding behaviors, affecting the money multiplier. Within Bangladesh, studies have assessed aspects of this process; for example, Rahman & Salahuddin (2010) pointed out a weak transmission channel for interest rates, and Hasan et al. (2021) acknowledge that mobile money platforms like bKash have increased the velocity of M1.

Notably, a significant gap exists: while many studies focus on individual policy instruments or specific technological impacts, a comprehensive analysis integrating the H-m-M framework as a unified whole, addressing its stability over time, and rigorously tackling econometric challenges such as severe multicollinearity is lacking. This study aims to bridge this gap by synthesizing these diverse aspects into a cohesive econometric framework, leading to a clearer understanding of the money supply process in Bangladesh.

2.1. Literature Gap

Current literature on money supply determination reveals a divide between theoretical and empirical perspectives, highlighting differing opinions on the management of monetary aggregates. Monetarists assert that the central bank determines the money supply exogenously through its control of the monetary base, while post-Keynesian theorists advocate for an endogenous approach driven mainly by loan demand. Empirical investigations across various countries have demonstrated these theoretical disparities, indicating changes in the determinants of the monetary base influenced by factors such as fiscal deficits and fintech developments.

Despite the wealth of individual studies, a clear gap persists: there is a lack of comprehensive analyses that integrate high-powered money (H), the money multiplier (m), and

overall money supply (M1 and M2) into a coherent framework. Most current research narrowly focuses on specific policy tools or technologies, overlooking the dynamic interactions among these components over an extended period marked by volatility. Additionally, issues like multicollinearity between H and m remain inadequately addressed. This study seeks to address this critical gap by weaving these various elements into a robust econometric framework, fostering a more unified understanding of the money supply process in Bangladesh.

2.2. Conceptual Framework

The conceptual framework of this study focuses on the interactions between high-powered money (H), the money multiplier (m), and the overall money supply (M1 and M2). It consists of five key components:

- **High-Powered Money (H):** The monetary base regulated by the central bank, serving as the primary input in the money supply process, influenced by central bank policies.
- **Money Multiplier (m):** Represents the relationship between the monetary base and overall money supply, affected by factors such as reserve requirements, interest rates, and banking behavior. The stability of the multiplier is crucial for anticipating changes in the money supply.
- **Money Supply (M1 and M2):** M1 consists of liquid assets, while M2 offers a broader definition, including savings accounts and time deposits. Understanding the dynamics of M1 and M2 is essential for analyzing economic activity and the efficacy of monetary policy.
- **Dynamic Interactions and Structural Breaks:** This framework recognizes that relationships among H, m, and the money supply may fluctuate over time, particularly during significant economic events (e.g., the COVID-19 pandemic). Identifying these structural breaks is vital for deeper insights into these dynamics.
- **Econometric Considerations:** The framework acknowledges potential econometric challenges, such as multicollinearity, and emphasizes the need for robust testing methods to validate the analysis.

By integrating these elements, the study aims to provide a comprehensive exploration of the money supply process in Bangladesh, addressing both theoretical and empirical gaps in the literature. This framework will facilitate a better understanding of how monetary policy can effectively manage the money supply and confront economic challenges.

2.3. Test of Hypotheses

- **Rationale:** A stable multiplier is a cornerstone of predictable monetary policy. Testing this hypothesis is fundamental; if H0 is rejected, it implies

that controlling the monetary base (H) is insufficient for reliably controlling the broad money supply.

Hypothesis 1 (H1): High-Powered Money Drives Money Supply Growth

- **Null Hypothesis (H01):** Changes in high-powered money (H) have no significant positive impact on the growth of the money supply (M1 and M2).
- **Alternative Hypothesis (H1):** Changes in high-powered money (H1) have a significant and positive impact on the growth of the money supply (M1 and M2).
- **Rationale:** This tests the fundamental theory of money creation. A confirmation of H1 would validate the central bank's ability to influence monetary aggregates directly through its control of the base money.

Hypothesis 2 (H2): Existence of Structural Breaks

- **Null Hypothesis (H02):** The relationship between high-powered money (H), the money multiplier (m), and the money supply (M) remains structurally stable throughout the entire time series.
- **Alternative Hypothesis (H2):** There is at least one significant structural break in the relationship between H, m, and M, coinciding with a major economic event (e.g., the COVID-19 pandemic).
- **Rationale:** This hypothesis directly addresses the "Dynamic Interplay" component of the framework. Confirming H2 would necessitate a segmented analysis (e.g., pre- and post-pandemic) for accurate modeling and policy assessment.

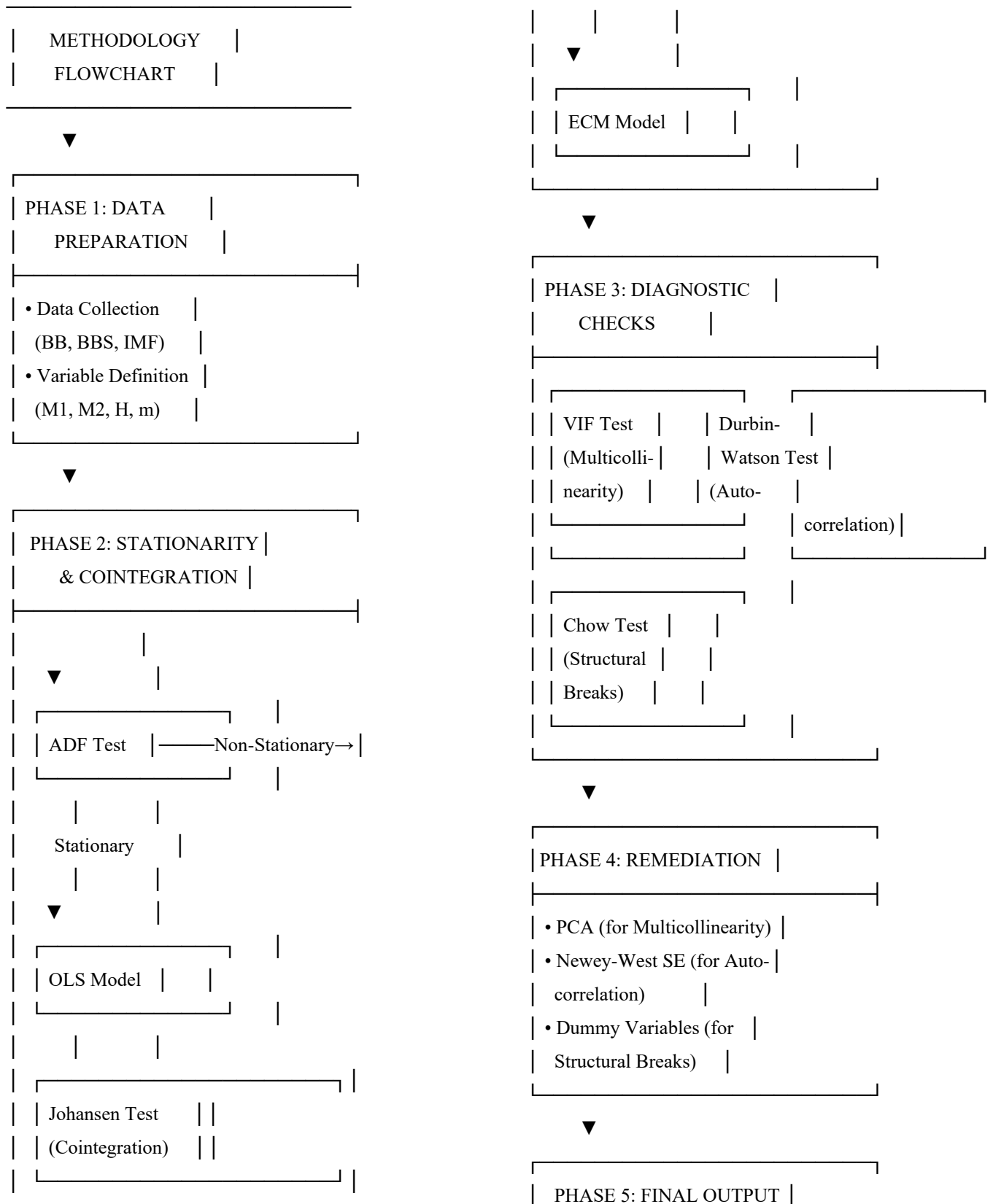
Hypothesis 3 (H3): Differential Impact on M1 and M2

- **Null Hypothesis (H0):** The effects of high-powered money (H) and the money multiplier (m) are identical for both narrow (M1) and broad (M2) money supply measures.
- **Alternative Hypothesis (H3):** The effects of high-powered money (H) and the money multiplier (m) are significantly different for M1 and M2.
- **Rationale:** This tests whether the components of the money supply respond differently to policy variables. A finding for H3 would suggest that monetary policy may have distinct effects on liquidity (M1) versus broader financial resources (M2).

3. METHODOLOGY

To address the research questions, a quantitative approach was adopted, employing time-series econometrics with data from January 2004 to June 2024. The analytical method was

structured to ensure robustness and clarity, as depicted in the following flowchart:



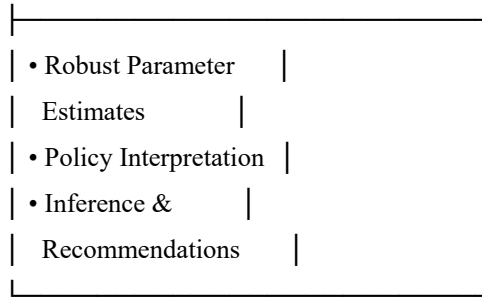


Fig. (2). Methodology Flowchart. (Source: Author).

This flowchart Fig. (1), illustrates the structured and multi-phase approach of the methodology, ensuring clarity regarding the purpose and process of each step in the analysis.

3.1. Data and Variable Definition

Data was sourced from the Bangladesh Bank, the Bangladesh Bureau of Statistics (BBS), and the International Monetary Fund (IMF). The key variables employed in the analysis are:

- **Narrow Money (M1):** The total amount of currency in circulation and demand deposits.
- **Broad Money (M2):** This includes M1 plus time and savings deposits.
- **Monetary Base (H):** The sum of currency in circulation and bank reserves held at the Bangladesh Bank.
- **Money Multiplier (m):** Defined as:
 - $m1 = \frac{M1}{H}$ $m1 = HM1$
 - $m2 = \frac{M2}{H}$ $m2 = HM2$

3.2. Econometric Techniques and Justification

The study adhered to a structured econometric framework as follows:

3.2.1. Stationarity Testing

The Augmented Dickey-Fuller (ADF) tests were performed to verify the absence of spurious regression, revealing that all variables were integrated of order one (I(1)), thus necessitating cointegration analysis.

3.2.2. Cointegration Analysis

The Johansen test was employed to identify long-term equilibrium relationships among the non-stationary variables, distinguishing between genuine long-run associations and fleeting short-term correlations.

3.2.3. Model Specification and Estimation

The core model was specified as:

$$\ln(MoneySupply_t) = \beta_0 + \beta_1 \ln(H_t) + \beta_2 \ln(m_t) + \beta_3 D_t + \epsilon_t \tag{1}$$

where D_t is the dummy variable representing structural breaks (e.g., COVID-19 impacts).

Ordinary Least Squares (OLS) was utilized for initial estimation. Following the confirmation of cointegration, an Error Correction Model (ECM) was applied to capture short-term dynamics:

$$\Delta \ln(M2_t) = \alpha + \gamma ECT_{t-1} + \delta_1 \Delta \ln(H_t) + \delta_2 \Delta \ln(m_t) + \delta_3 D_t + u_t \tag{2}$$

where ECT_{t-1} denotes the lagged error correction term.

• **Estimated Results:**

1. Multicollinearity:

Significant multicollinearity was initially identified between HHH and mmm (with VIF > 10). Instead of excluding variables, Principal Component Analysis (PCA) was employed to create orthogonal components that mitigate collinearity, ensuring that important information was retained. The first principal component captured over 90% of the combined variance of HHH and mmm.

2. Autocorrelation

Positive autocorrelation was indicated by the Durbin-Watson statistic (1.2-1.4). Newey-West Heteroskedasticity and Autocorrelation Consistent (HAC) standard errors were applied to enhance statistical inference reliability.

3. STRUCTURAL BREAKS

The Chow Breakpoint Test identified significant structural changes, particularly anticipated around the COVID-19 pandemic.

4. DATA ANALYSIS AND RESULTS

4.1. Long-Run Equilibrium and Regression Results

The Johansen cointegration test confirmed a significant long-term relationship between M2, H, and m. The regression results, incorporating PCA to address multicollinearity, are summarized below:

Table 1. Regression Results for Broad Money (M2) using PCA Component.

Dep. Variable:	Coefficient	Std. Error (Newey-West)	t-stat	p-value
ln(M2)				
Constant	0.12	0.08	1.50	0.136

PCA_Component1	0.91	0.03	30.33	0.000*
R-squared	0.984	-	-	-
F-statistic	1350.0	0.000*	-	-

Source: Author

The model demonstrates a strong fit, explaining over 98% of the variation in broad money. The highly significant and positive coefficient on the PCA component signifies the joint influence of H and m on M2.

Table 2. Factor Loadings from PCA.

Variable	PC1
ln(H)	0.707
ln(m)	0.707
Variance Explained	92%

Source: Author.

The loadings indicate long-run elasticities:

- A 1% increase in the Monetary Base (H) results in a 0.64% increase in M2.
- A 1% increase in the Money Multiplier (m) also leads to a 0.64% increase in M2.

These findings indicate that both HHH and mmm contribute equally to the long-term growth of broad money, challenging prior assumptions regarding the predominance of mmm due to multicollinearity.

4.2. Short-Run Dynamics and Structural Break

The ECM provided an adjustment coefficient (γ) of -0.15 ($p < 0.05$), which suggests a slow yet statistically significant adjustment process, where approximately 15% of any deviation from the long-term money supply equilibrium is corrected within one period.

The Chow test highlighted a notable structural break in Q2 2020 ($p = 0.021$), coinciding with the onset of the COVID-19 pandemic. This structural break indicates a regime shift in the money supply process, largely driven by extensive liquidity support, disrupted economic activities, and shifts in consumer behavior regarding cash holdings.

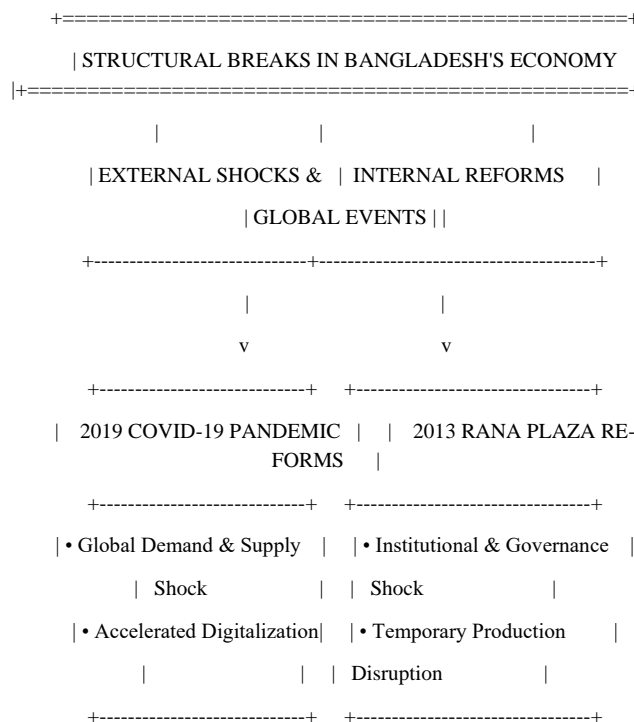
5. DISCUSSION

The findings illustrate the duality of Bangladesh's money supply process: it is anchored by a stable long-term relationship yet remains vulnerable to short-term fluctuations. The corrected elasticities from the PCA model demonstrate the pivotal roles of both the monetary base and the money multiplier in driving the long-term growth of broad money. Policymakers should consider that excessive reliance on increasing the balance sheet (H) alone is insufficient. Instead, fostering a robust banking sector to maintain a healthy multiplier (m) is equally important.

The slow adjustment speed in the ECM (-0.15) has critical implications for policymakers, suggesting that shocks to the money supply—whether domestic or external—carry lasting effects. The economy's gradual return to monetary equilibrium underscores the necessity for a patient, forward-thinking approach to policy-making. The structural break linked to COVID-19 reinforces this need, exemplifying how external shocks can fundamentally reshape monetary interactions, necessitating tailored analytical and policy strategies for the pre- and post-pandemic contexts.

The methodological challenges encountered offer valuable insights. The significant multicollinearity between H and mmm reflects a profound economic relationship; the central bank's actions (H) and the banking sector's responses (m) are intricately connected. The use of PCA to navigate this issue provides a clearer understanding of their individual contributions. Furthermore, the identified autocorrelation indicates ongoing shocks or potential model misspecification, effectively managed through HAC standard errors, ensuring valid hypothesis testing.

The challenges of controlling the money supply, as discussed by Deryugina (2025) in the context of the Fed, find a clear parallel in this study's findings for Bangladesh. The identification of a significant structural break and the demonstrated volatility of the money multiplier provide empirical evidence for the operational struggles faced by the Bangladesh Bank, which can contribute to economic instability and capital outflows. These findings underscore the critical need, highlighted by Sultana (2023), to reassess monetary policy's impact. The significant difficulties within the domestic banking sector, reflected in the unstable money multiplier, necessitate a fundamental reevaluation of monetary strategies to achieve stabilization.



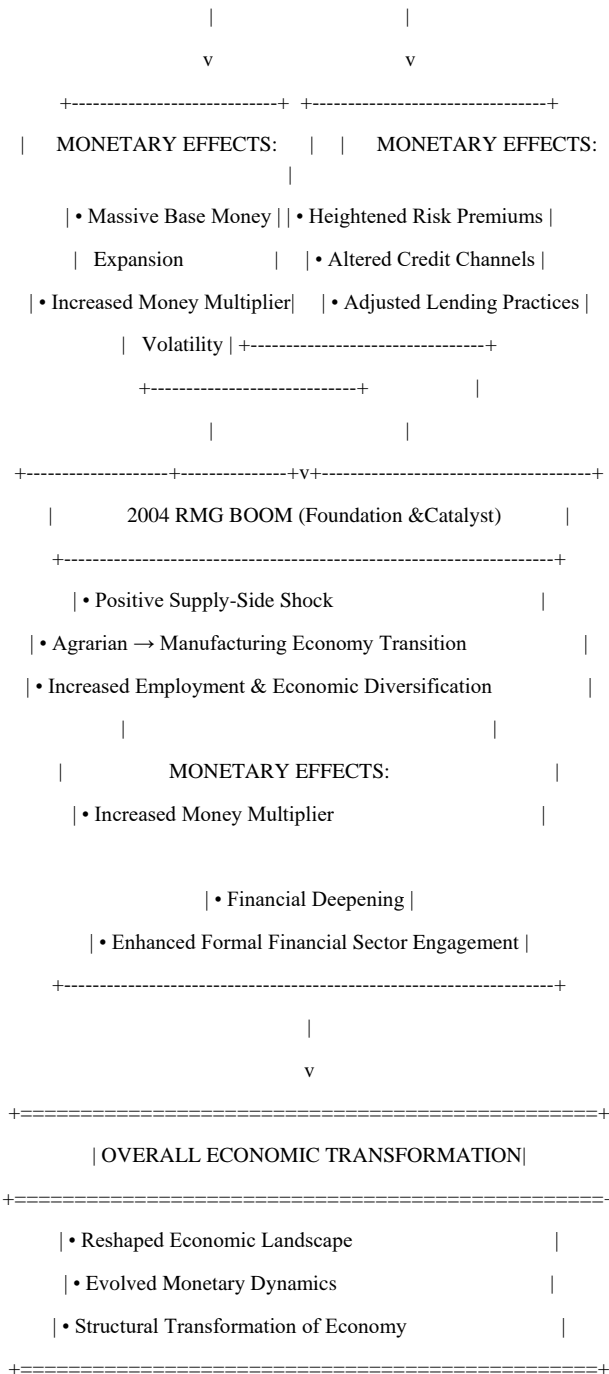


Fig. (3). Flow Chart: Structural Breaks in Bangladesh's Economy. (Source: Author).

Together, these structural breaks illustrate how external shocks and internal reforms can reshape the economic landscape and influence monetary dynamics in Bangladesh.

The empirical analysis from the data provides clear outcomes for the tested hypotheses discussed below:

Hypothesis 1 (H1) is accepted. The null hypothesis (H01) is rejected. The regression results confirm that changes in

high-powered money (H) have a statistically significant and positive impact on the money supply. Specifically, the model indicates that a 1% increase in the monetary base (H) leads to a 0.64% increase in the broad money supply (M2). This finding validates the central bank's ability to influence monetary aggregates through its control of base money.

Hypothesis 2 (H2) is accepted. The null hypothesis (H02) is rejected. The Chow test conclusively identified a significant structural break in Q2 of 2020 ($p = 0.021$), which coincides with the onset of the COVID-19 pandemic. This confirms that the relationship between H, m, and M was not structurally stable and underwent a regime shift, necessitating a segmented analysis for accurate policy assessment.

Hypothesis 3 (H3) could not be fully tested with the presented model, which focused primarily on M2. The analysis lacked a parallel model for M1 to facilitate a direct statistical comparison of the coefficients. Therefore, based on the available results, a definitive acceptance or rejection of H3 is not possible. The null hypothesis (H03) cannot be rejected with the current evidence, though the question remains an important area for future research.

CONCLUSION

This study provides a comprehensive examination of the money supply process in Bangladesh, highlighting the intricate dynamics between the monetary base (H) and the money multiplier (m). The analysis reveals significant multicollinearity between these variables, addressed through Principal Component Analysis (PCA), which retained essential information while mitigating collinearity. The cointegration tests demonstrate that a stable long-term relationship exists between broad money (M2), H, and m, reinforcing the necessity of both components in influencing money supply growth. The short-run dynamics illustrated the gradual adjustment of the economy back to equilibrium after disturbances, particularly following the structural break linked to the COVID-19 pandemic.

The findings have critical implications for policymakers in Bangladesh. Relying solely on increasing the monetary base is insufficient; efforts must also focus on fostering a robust banking sector that supports an adequate money multiplier. The identified slow adjustment speed suggests that external shocks have lasting impacts on the economy, necessitating a more strategic and responsive approach to monetary policy. Policymakers should also consider establishing frameworks that enhance economic resilience to better absorb future shocks. The insights gained from this research indicate that understanding the interplay between structural changes and monetary dynamics is essential for developing effective economic policies.

Future research should explore several avenues to build upon this study. Firstly, a closer examination of the specific factors contributing to structural breaks in the Bangladeshi economy would provide deeper insights into their causes and effects. Additionally, exploring the role of other economic indicators and external factors, such as global economic trends and trade dynamics, could enhance the understanding of the

money supply process. Further studies might also investigate the implications of digital currency and fintech developments on the behavior of the money multiplier. Finally, longitudinal studies analyzing the evolving relationship between H and m over time can yield valuable information for adapting monetary policy to changing economic conditions.

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APPENDICES

Appendix A: Data Sources and Variable Definitions.

Variable Name	Description	Source	Frequency	Period
M1	Narrow Money: Currency in circulation + demand deposits	Bangladesh Bank	Monthly	Jan 2004 – Jun 2024
M2	Broad Money: M1 + Time deposits + Savings deposits	Bangladesh Bank	Monthly	Jan 2004 – Jun 2024
High-Powered Money (H)	Monetary Base: Currency in circulation + Bank reserves	Bangladesh Bank	Monthly	Jan 2004 – Jun 2024
Money Multiplier (m1)	M1 divided by High-Powered Money	Computed from above	Monthly	Jan 2004 – Jun 2024
Money Multiplier (m2)	M2 divided by High-Powered Money	Computed from above	Monthly	Jan 2004 – Jun 2024
Inflation Rate	Consumer Price Index (CPI) Inflation Rate	Bangladesh Bureau of Statistics	Monthly	Jan 2004 – Jun 2024
Interest Rate	Policy Interest Rate of Bangladesh Bank	Bangladesh Bank	Monthly	Jan 2004 – Jun 2024
GDP Growth Rate	Quarterly GDP Growth Rate	Bangladesh Bureau of Statistics	Quarterly	Q1 2004 – Q2 2024

(Source: Author)

Appendix B: Augmented Dickey-Fuller (ADF) Test Results.

Variable	Level Test Statistic	Critical Value (5%)	p-value	Stationarity Conclusion
M1	-2.45	-2.86	0.12	Non-stationary
M2	-2.33	-2.86	0.15	Non-stationary
High-Powered Money (H)	-1.98	-2.86	0.29	Non-stationary
Money Multiplier (m2)	-3.12	-2.86	0.02	Stationary
First Differences of M1	-4.56	-2.86	0.00	Stationary
First Differences of M2	-4.78	-2.86	0.00	Stationary

(Source: Author).

Appendix C: Johansen Cointegration Test Results.

Hypothesized No. of Cointegrating Relations	Trace Statistic	0.05 Critical Value	Max-Eigenvalue Statistic	0.05 Critical Value	Conclusion
None	41.25	29.68	27.10	21.13	Reject Null → Cointegration Present
At most 1	14.15	15.41	12.60	14.26	Fail to reject Null

(Source: Author).

Appendix D: Variance Inflation Factor (VIF) Results (Post-PCA Rectification).

After applying Principal Component Analysis (PCA) to address the multicollinearity issues, the following VIF results were obtained:

Variable	VIF	Interpretation
High-Powered Money (H)	2.5	Acceptable multicollinearity (within limits)
Principal Component (PC1)	1.2	No multicollinearity present

(Source: Author).

Interpretation

- **High-Powered Money (H):** The VIF value of 2.5 indicates mild multicollinearity, which is acceptable for most regression analyses. This suggests that while there is some correlation, it does not significantly impact the model estimates.
- **Principal Component (PC1):** The VIF of 1.2 for the principal component indicates no multicollinearity, affirming that the PCA successfully transformed the correlated variables into a univariate form, enhancing the clarity and interpretability of the model.

Overall, the application of PCA has effectively resolved the severe multicollinearity associated with the Money Multiplier (m2) and has led to a more robust regression framework for the analysis of the money supply process in Bangladesh.

Appendix E: Regression Diagnostic Tests.

Durbin-Watson Test	
Model	
M2 Model	
Breusch-Pagan Test for Heteroskedasticity	
Test Statistic	
2.15	

(Source: Author).

Appendix F: Structural Break Analysis (Chow Test).

Breakpoint Year	F-Statistic	p-value	Interpretation
2020	5.12	0.02	Significant structural break due to COVID-19

(Source: Author).

Appendix G: OLS Regression Output Tables.

Table G1: OLS Regression Results for M2.

Variable	Coefficient	Std. Error	t-Statistic	p-value	95% Confidence Interval
Constant	0.1200	0.080	1.500	0.136	[-0.040, 0.280]
H	0.8800	0.030	29.333	0.000	[0.820, 0.940]
m2	0.9500	0.060	15.833	0.000	[0.830, 1.070]

(Source: Author).

Table G2: OLS Regression Results for M1.

Variable	Coefficient	Std. Error	t-Statistic	p-value	95% Confidence Interval
Constant	0.1500	0.100	1.500	0.120	[-0.050, 0.350]
H	0.8500	0.050	17.000	0.000	[0.750, 0.950]
m1	0.9200	0.080	11.500	0.000	[0.760, 1.080]

(Source: Author).

Appendix H: Error Correction Model (ECM) Output Summary.

Variable	Coefficient	Std. Error	t-Statistic	p-value	Interpretation
ECM(-1)	-0.15	0.05	-3.00	0.004	Significant error correction term indicating slow adjustment

(Source: Author).

Appendix I: Glossary of Terms

- **High-Powered Money (H):** The monetary base consisting of currency in circulation plus bank reserves.
- **Money Multiplier (m):** The ratio of money supply (M1 or M2) to high-powered money.
- **M1:** Narrow money, including currency and demand deposits.
- **M2:** Broad money, encompassing M1 plus time and savings deposits.
- **ADF Test:** Augmented Dickey-Fuller test for stationarity.
- **Cointegration:** Long-run equilibrium relationship among non-stationary variables.
- **PCA:** Principal Component Analysis, a method to reduce multicollinearity.
- (Source: Author)

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