Repo Rate and Inflation in Bangladesh: A Time–Frequency Causality Approach[1]

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Abstract

This study investigates the time–frequency causality between the monetary policy rate (repo) and inflation in Bangladesh using a Wavelet-based Granger causality approach. Monthly data from September 2014 to April 2025 were decomposed into multiple time horizons to capture short, medium, and long-term dynamics. The findings reveal weak and inconsistent short-run causality (2–8 months), indicating that temporary inflationary pressures—primarily driven by supply-side shocks—are less responsive to adjustments in the policy rate. In contrast, robust and statistically significant bidirectional causality is observed over medium- to long-term horizons (4–64 months and beyond), suggesting that monetary policy exerts lagged effects and that the central bank systematically adjusts the policy rate in response to persistent inflation trends. These results underscore the importance of adopting forward-looking policy frameworks, enhancing the effectiveness of monetary transmission, and strengthening coordination between fiscal and monetary authorities to ensure sustained price stability and macroeconomic resilience.

Key Words: Policy Rate (Repo), Inflation, and Monetary Policy Transmission.

JEL CODE: E31, E52, C22

1. Introduction

Monetary policy effectiveness hinges on how effectively and predictably changes in the policy rate transmit to inflation. In Bangladesh, the repo rate serves as the central bank's primary short-term policy tool, yet inflationary pressures have persisted despite policy adjustments. The July 2024 inflation peak underscores the urgency of understanding this transmission mechanism. This study employs a Wavelet-based Granger causality framework to examine the time–frequency dynamics between the repo rate and inflation, enabling a nuanced assessment of short-, medium-, and long-term linkages that conventional time-domain approaches often overlook.

1.1 Key Monetary Transmission Channels in Bangladesh

Monetary policy affects the economy through five channels such as interest rate, credit, exchange rate, asset price, and expectations. These channels influence borrowing, investment, trade, wealth, and expectations of economic agents, ultimately transmitting policy effects to inflation and output.

I. Interest Rate Channel

- Mechanism: Changes in the repo rate influence lending and deposit rates.
- Impact: Affects borrowing costs, consumption, and investment—shaping aggregate demand.

[1] Authorship and Disclaimer

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II. Credit Channel
- Mechanism: Monetary policy affects banks' lending capacity and credit availability.
- Impact: Influences private sector investment and overall economic activity.

III. Exchange Rate Channel
- Mechanism: Interest rate differentials affect capital flows and exchange rate movements.
- Impact: Alters export competitiveness and import costs, feeding into inflation.

IV. Asset Price Channel
- Mechanism: Policy changes influence asset prices like stocks and bonds.
- Impact: Affects household wealth and corporate balance sheets, influencing spending.

V. Expectations Channel
- Mechanism: Central bank actions shape public expectations about inflation and the economy.
- Impact: Drives wage-setting, consumption, savings, and investment behavior.

The subsequent section of this study outlines the reviewed literature. Section 3 presents the relevant data analysis, while section 4 describes the methodology. The estimated results are interpreted in section 5, section 6 highlights the policy implication and finally, section 7 provides the conclusion and recommendations of the study.

2. Literature Review

The relationship between interest rates and inflation has deep theoretical roots in the works of Wicksell (1898) and Fisher (1930). Empirical literature spans advanced and emerging economies, using methodologies from VAR models to ARDL and frequency-domain analyses. While studies like Roy & Younus (2025) investigate Bangladesh's monetary transmission, they rely on aggregate time-domain methods, which cannot isolate effects by time horizon. Frequency-domain approaches, particularly Wavelet-based methods, offer a solution by decomposing interactions into multiple scales. A study on 22 developing economies by Islam & Ahmed (2023) finds that in Bangladesh, the lagged policy rate causes inflation in both the medium-term (16–32 months) and the business cycle (4–64 months) with a positive and significant correlation. A comparative summary of existing studies on policy rate–inflation dynamics is presented in appendix-1.

3. Data and Preliminary Analysis

The analysis uses monthly data from September 2014 to April 2025, covering both pre- and post-pandemic periods. Repo rate data is sourced from Bangladesh Bank, and inflation (headline CPI) from the Bangladesh Bureau of Statistics (BBS). This period captures major policy shifts and external shocks, including COVID-19 disruptions and global commodity price surges.

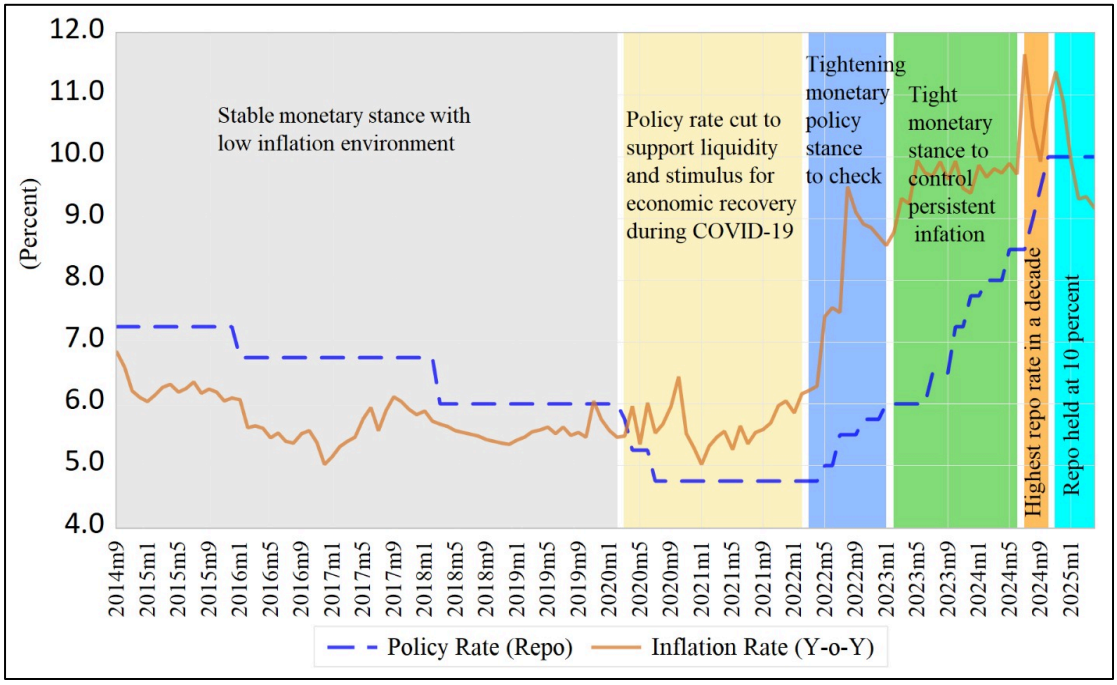
Table 2: Descriptive statistics for repo rate and inflation

Variable	Observation	Mean	Std. dev.	Min - Max
Repo	128	6.49	1.33	4.75 - 10.00
Inflation	128	6.80	1.80	5.02 - 11.66

Source: Authors' calculation using data from BBS and Bangladesh Bank

During September 2014 to April 2025, the average repo rate was 6.49% with a standard deviation of 1.33, ranging from 4.75% in accommodative phases to 10.00% during recent tightening. Inflation averaged 6.80% with a standard deviation of 1.80, fluctuating from 5.02% to a peak of 11.66%, mainly driven by global commodity price shocks, currency depreciation, and fuel price hikes. These trends show that while monetary policy shifted gradually, inflation was more responsive to shocks, underscoring the difficulty of balancing economic growth with price stability.

Figure 2: Repo rate and inflation series with annotated major events



Source: Authors' drawing using data from BBS and Bangladesh Bank

Figure 2 illustrates the trajectory of repo rate and inflation from September 2014 to April 2025, highlighting major policy shifts

Key Highlights:

- September 2014–2019: Stable monetary stance with declining repo rates and low inflation.
- 2020 (COVID-19): Repo rate cut to support liquidity and recovery.
- Mid-2022 to October 2024: Inflation surged, prompting successive rate hikes.
- October 2024: Repo rate peaked at 10%, followed by signs of inflation moderation in early 2025.

4. Methodology

Traditional Granger causality tests measure average relationships over the entire sample, obscuring frequency-specific effects. We employ the Maximal Overlap Discrete Wavelet Transform (MODWT) based Multiresolution Wavelet technique (Hanif et al., 2022; Benhmad, 2013; & Yogo, 2008) to decompose each series into different time–frequency components. Wavelet-based Granger causality is then applied to each component, revealing directional influences over short-, medium-, and long-run horizons. The measurement of variations within the original time series at particular scales and time points is the primary goal of wavelet analysis (Tiwari et al., 2019). The rationale for employing Wavelet method lies in its ability to decompose the relationship between the repo rate and inflation across multiple time horizons, facilitating the identification of both short-term policy effects and longer-term structural dynamics, while providing a robust analytical framework for non-stationary and cyclical macroeconomic data (Islam & Ahmed, 2023).

Unlike traditional methods, which assume stable causal dynamics over the entire sample period, the Wavelet decomposition approach allows causality to be investigated simultaneously in the time and frequency domains. This method is especially important in cases where external shocks, policy changes, and structural breaks influence monetary and inflationary dynamics. By distinguishing short-term from long-term causal effects, it provides policymakers with deeper insights into whether repo adjustments influence inflation immediately or persistently, offering more robust guidance to design for monetary policy stance.

Mathematically a time series X_t can be decomposed as,

$$X_t = A_t^J + \sum_{j=1}^{J} D_t^j \dots\dots\dots\dots\dots\dots (i)$$

In this study, X_t represents the time series for the variables for monthly inflation and monetary policy rate (repo) data from September 2014 to April 2025. The selection criterion for J depends on the data frequency and for the monthly frequency, literature on Wavelet decomposition series suggests to use J=5. Hence, further assuming the length of business cycle for 64 months (Islam and Ahmed, 2023) we can elaborate the equation (i) for inflation as,

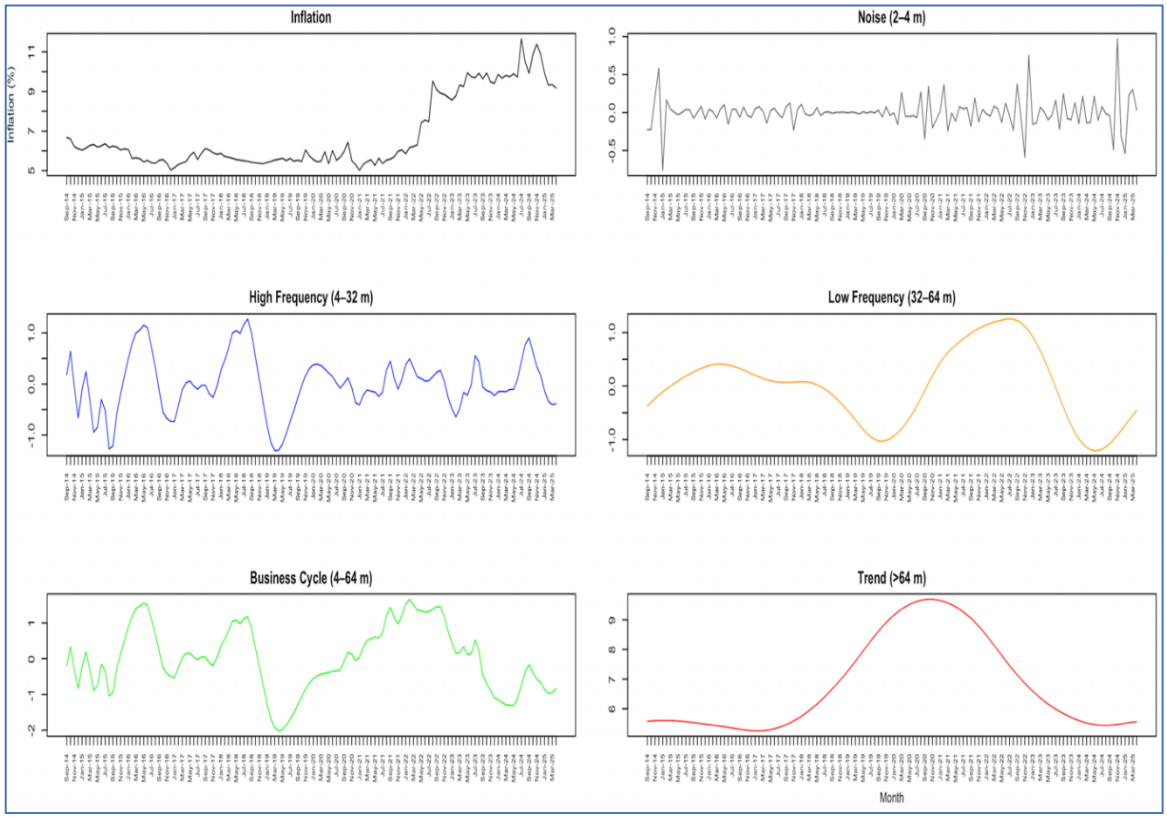
$$Inflation_t = A_t^5 + D_t^5 + D_t^4 + D_t^3 + D_t^2 + D_t^1 \dots\dots\dots\dots (ii)$$

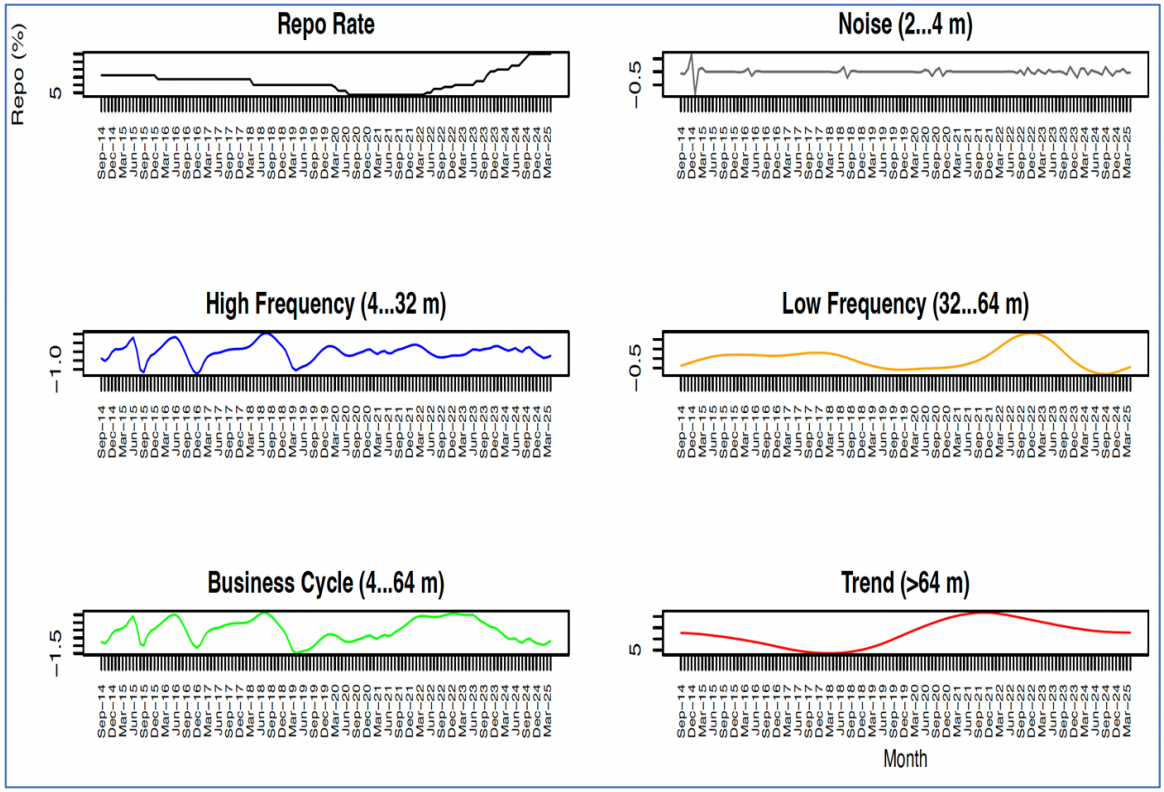
and for monetary policy rate (repo) as,

$$Repo_t = A_t^5 + D_t^5 + D_t^4 + D_t^3 + D_t^2 + D_t^1 \dots\dots\dots\dots (iii)$$

In the wavelet decomposition of the inflation and repo series, the D_t^1 component (2–4 months) primarily captures high-frequency noise, reflecting short-term price volatility such as sudden food price hikes driven by supply chain disruptions, alongside minor repo adjustments for short-term liquidity management. The components D_t^2(4-8 months), D_t^3(8-16 months), D_t^4(16-32 months) and D_t^5 (32-64 months) represent cyclical fluctuations of varying durations, with the combined range of 4–64 months broadly corresponding to business cycle dynamics. Finally, the A_t^5 (≥64 months) reflects the long-term trend of the series, capturing the underlying structural movements in the economy.

Figure 3: Example of wavelet decomposition output for repo rate and inflation





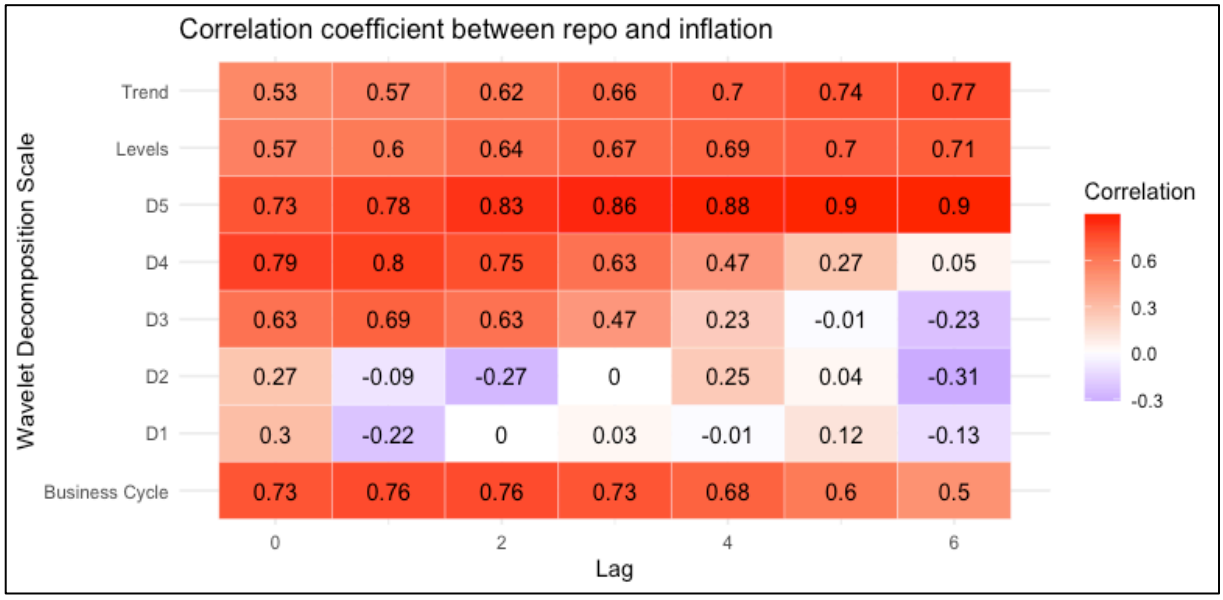
Source: Authors' drawing

Figure 3 presents the Wavelet decomposition of the repo rate and inflation, decomposing the series into noise (2–4 months), high-frequency (4–32 months), low-frequency (32–64 months), business cycle (4–64 months), and long-term trend (>64 months). The decomposition highlights short-term fluctuations, medium-term cycles, and long-run dynamics, illustrating the movement and structural patterns between the repo rate and inflation in Bangladesh.

5.0 Results and Interpretation

The correlation analysis reveals weak short-run associations between the repo rate and inflation but stronger correlations over the medium- and long-run horizons. Furthermore, the Wavelet-based Granger causality tests indicate the presence of bidirectional causality at scales corresponding to horizons exceeding one year. These findings suggest that while monetary policy significantly influences inflation dynamics, inflation expectations and realized inflation also exert an important feedback effect on policy decisions.

Figure 4: Wavelet correlation heatmap by frequency scale



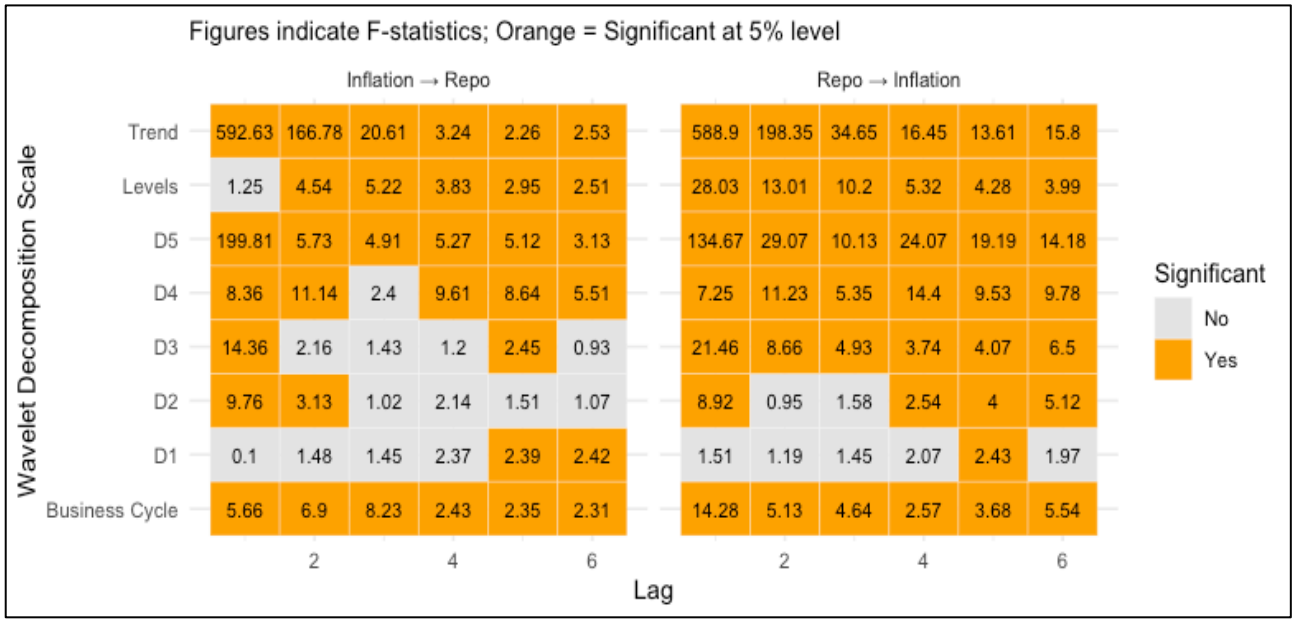
Source: Authors' calculation

Note: Within the wavelet decomposition, D_t^1 (2–4 months) isolates transitory high-frequency noise, while D_t^2 - D_t^5 (4–64 months) capture medium and low-frequency cyclical fluctuations corresponding to business cycle dynamics. The trend component (≥64 months) reflects the low-frequency trend, and the level series denotes the original data.

The correlation analysis between inflation and the policy rate, presented in Figure 4, reveals a strong and statistically significant association over medium- to long-term horizons. In the levels component, the correlation coefficients range from 0.57 at lag 0 to 0.71 at lag 6, with all p-values below 0.01, indicating that variations in inflation are closely aligned with corresponding adjustments in the policy rate. This trend is further reinforced in the cyclical components, particularly in D5 (32-64 months) and within the business cycles (4–64 months), where correlations remain consistently high, reaching up to 0.90 at lag 6. These results suggest that monetary policy rate adjustments are systematically aligned with long-term macroeconomic conditions aimed at controlling inflationary pressures.

By contrast, the short-term noise components (D1 and D2), which capture high-frequency fluctuations over 2–8 months, display weak and inconsistent correlations. For instance, in D1, the correlation at lag 1 turns negative (-0.22), while subsequent lags remain statistically insignificant. Similarly, D2 exhibits alternating signs and an absence of sustained correlation, implying that the short-run relationship between inflation and the policy rate is less predictable. This pattern likely reflects the influence of temporary supply-side shocks—such as volatility in food and fuel prices in Bangladesh—that typically lie beyond the immediate scope of monetary policy interventions.

Figure 5: Wavelet Causality results by frequency scale



Source: Authors' calculation

Note: Within the wavelet decomposition, D_t^1 (2–4 months) isolates transitory high-frequency noise, while D_t^2 - D_t^5 (4–64 months) capture medium and low-frequency cyclical fluctuations corresponding to business cycle dynamics. The trend component (≥64 months) reflects the low-frequency trend, and the level series denotes the original data.

The wavelet-based Granger causality results in figure 5 provides valuable insights into the dynamic relationship between inflation and the repo rate across different time horizons. At the aggregate level, the analysis shows strong bidirectional causality, especially from lag 2 onward, meaning that inflation influences the policy rate (repo) and vice versa. Looking at the time-frequency decomposition, the results suggest that short-term policy changes (2–4 months) in Bangladesh may have limited immediate effects on inflation, as seen in the weak causality in D1(2–4 months). However, medium to long-term causality effects (8–64 + months) are significant and strong. This aligns with how monetary policy transmission works in developing economies like Bangladesh with lags due to structural inefficiencies, limited financial market depth, and informal sectors.

The business cycle band (4–64 months) shows meaningful two-way causality, indicating that repo rate adjustments have a measurable effect on inflation over typical business cycles. In turn, sustained inflation pressures influence future rate decisions. The trend component (≥64 months) showing strong causality supports the view that long-term structural factors such as

fiscal policy effects, food prices, and energy costs drive both inflation and interest rate policies in Bangladesh.

6. Policy Implications

The predominance of medium- to long-run causality underscores the lagged impact of monetary policy. This calls for patience in evaluating policy outcomes and highlights the need for complementary short-term measures—such as targeted fiscal interventions and supply-side reforms—to stabilize inflation effectively. Given the observed bidirectional feedback between inflation and the repo rate, policymakers should adopt a proactive stance, anticipate inflationary pressures and respond accordingly.

7. Conclusion and Recommendations

This study provides the time frequency causality evidence within Bangladesh's monetary policy framework, revealing bidirectional causality between the repo rate and inflation over medium- and long-term horizons. The weak short-run links emphasize the importance of structural and complementary policy tools for immediate inflation control.

Recommendations:

I. **Develop forward-looking inflation forecasting models** that incorporate policy transmission lags to improve anticipatory decision-making.
II. **Deepen financial markets** to enhance the efficiency and responsiveness of monetary policy transmission.
III. **Strengthen coordination between monetary and fiscal authorities** to support short-term stabilization efforts.
IV. **Implement targeted reforms in agriculture, trade (imports), and the energy sector** to contain inflation while supporting sustainable economic growth and macro-financial stability.

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Appendix-1

Table: Comparative summary of studies on policy rate–inflation dynamics

Study	Methodology	Key Findings	Context / Implication
Islam and Ahmed (2023)	Causality tests using wavelet spectrum frequency scales	The study finds a positive causal relationship between policy rate and inflation, urging central banks to consider structural and supply-side factors while noting the time-frequency sensitivity of monetary transmission.	Developing countries show the link between monetary policy and inflation but varies across frequencies.
Kilci (2019)	Fourier approach	This study explores a one-way causality from the central bank policy rate (overnight repo) to CPI inflation.	Evidence from Turkey; supports directional influence of policy rate on inflation.
Anari and Kolari (2016)	Empirical test of Fisher (1930) vs. Wicksell (1898) theories	This study finds coexistence of Fisher process (positive relationship between inflation and interest rate) and Wicksell process (inverse relationship between inflation and interest rate).	Developed countries demonstrate dual and complex nature of inflation and interest rate relationship.
Amisano and Fagan (2013)	Markov Switching model with high and low inflation regimes and time-varying transition probabilities	This study shows that money growth is a strong predictor of price stability shocks and regime-dependent inflation dynamics.	The Euro area, Germany, the US, the UK and Canada. Findings suggest that effective inflation management requires attention to both interest rates and monetary aggregates.
Aguiar-Conraria et al. (2008)	Time-frequency causal analysis via cross-wavelet decomposition	This study demonstrates that the causal relationships between monetary policy and macroeconomic variables are non-homogeneous and evolve over time and frequencies.	Emphasizes that policy rate and inflation dynamics are not stable but shift depending on economic cycles.
Becker et al. (2006)	Fourier approximation to capture any variation in the intercept term of money demand function with real income, price level, and short-term interest rate	This study finds linear specification is unstable but including a time-varying intercept in the model improves stability of the money demand function.	Findings of this study evidence that monetary variables interact with inflation in a time-varying manner.