Journal DOI: 10.36713/epra1013 | SJIF Impact Factor (2025): 8.619 ISSN: 2347-4378
EPRA International Journal of Economics, Business and Management Studies (EBMS)
Volume: 13 | Issue: 1 | January 2026 -Peer-Reviewed Journal

SHORT-TERM INTEREST RATES AND INFLATIONARY DYNAMICS: AN ARDL BOUNDS TESTING APPROACH TO THE RELATIONSHIP BETWEEN MONETARY POLICY, 91-DAY TREASURY BILL, AND CONSUMER PRICE INDEX

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ABSTRACT

This study examines the relationship between short-term interest rates and inflation in Ghana using monthly data from January 1971 to June 2025. The Consumer Price Index (CPI) was transformed into an inflation series to meet integration requirements, enabling the use of the autoregressive distributed lag (ARDL) bounds testing approach. The results reveal three important findings. Inflation displays strong persistence, confirming that past price changes strongly influence current outcomes. Treasury bill yields significantly co-move with inflation in the short run, reflecting their role as forward-looking indicators of market expectations. By contrast, the monetary policy rate exerts weak and inconsistent short-run effects, even under the inflation-targeting framework. Bounds testing confirmed a long-run relationship, but the error correction model showed that adjustment arises mainly from inflation itself, with nearly 42 percent of disequilibria corrected each month. Monetary policy in Ghana should rely more on market-based instruments, especially Treasury bills, while improving fiscal - monetary coordination and addressing structural and exchange-rate constraints to better anchor inflation expectations. A further application of nonlinear ARDL (NARDL) or regime-switching models could help capture possible asymmetries and structural breaks, given Ghana's history of policy regime changes and external shocks.

KEYWORDS: *Treasury bill, Inflation, Monetary Policy, ARDL*
JEL Codes: E31, E43, E52, C32, O55

1.0 BACKGROUND

Inflation remains one of the most persistent macroeconomic challenges confronting emerging and developing economies, and Ghana is no exception. Since independence, successive governments have grappled with inflationary pressures, largely fueled by fiscal imbalances, external shocks, and weak monetary transmission mechanisms. With the adoption of an inflation-targeting framework in 2007, the Bank of Ghana (BoG) placed the Monetary Policy Rate (MPR) at the core of its signaling mechanism for monetary policy stance, while the 91-day Treasury bill (T-bill) yield has remained a benchmark for short-term market interest rates and a key instrument for government financing (Bleaney et al., 2018; Bank of Ghana, 2022). Understanding how these two interest rate indicators affect consumer prices, proxied by the Consumer Price Index (CPI), is crucial for assessing the effectiveness of monetary policy in Ghana.

Despite the centrality of the MPR and T-bill rates in Ghana's policy architecture, the transmission of monetary policy to inflation has been subject to debate. Studies have shown that while the MPR often influences interbank rates, its pass-through to lending rates and inflation is slow and sometimes incomplete (Kovanen, 2011; Akosah, 2015). At the same time, the 91-day T-bill yield has been found to co-move with inflation in the long run, consistent with Fisher's hypothesis, yet the short-run relationship remains less clear (Luguterah & Logubayom, 2014). These dynamics highlight the need for further empirical investigation using robust econometric methods that can disentangle short-run adjustments from long-run equilibria.

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Ghana's monetary history further complicates the analysis. Prior to the formal adoption of the MPR in 2002, the country experienced a series of policy regime changes, ranging from direct credit controls to monetary targeting. Such structural changes suggest the possibility of breaks in the relationship between interest rates and inflation. In addition, exchange rate volatility and fiscal dominance have frequently weakened the effectiveness of monetary policy (IMF, 2024; Valogo, 2023). These complexities make it imperative to examine the joint interaction between the MPR, the 91-day T-bill, and Consumer Price Index/inflation over an extended period that captures the evolution of Ghana's monetary regimes.

The Autoregressive Distributed Lag (ARDL) bounds testing approach, developed by Pesaran, Shin, and Smith (2001), provides a suitable framework for this study. Unlike other cointegration techniques, ARDL is robust to small samples and can be applied when variables are integrated of mixed order, $I(0)$ and $I(1)$, but not $I(2)$. Moreover, it allows for a decomposition of both long-run equilibrium relationships and short-run dynamics. Employing this method on monthly data spanning January 1971 to June 2025 will provide new insights into the effectiveness of Ghana's short-term interest rate instruments in stabilizing inflation.

2.0 LITERATURE REVIEW

The theoretical foundation of the interest rate–inflation nexus is grounded in Fisher's hypothesis, which posits that nominal interest rates incorporate expected inflation (Fisher, 1930). In modern monetary economics, short-term policy rates influence aggregate demand and inflation through the interest rate channel of monetary transmission, while money market rates such as Treasury bills reflect investor expectations about future inflation (Mishkin, 2016). For Ghana, both the MPR and the 91-day T-bill are central to this process, with the former signaling the stance of monetary policy and the latter reflecting market responses (Bleaney et al., 2018).

Empirical studies on Ghana reveal mixed evidence on the effectiveness of the MPR. Kovanen (2011) found that interest rate pass-through from the policy rate to retail lending rates is present but incomplete, while Akosah (2015) reported that the MPR does influence short-term market rates, although the effects vary in magnitude over time. More recent studies highlight that the credibility of the MPR as a policy anchor has improved under the inflation-targeting regime, but its transmission to inflation remains weak (Mbilla, 2021; BoG, 2024).

On the role of Treasury bills, several studies have established a long-run relationship between T-bill yields and inflation. Luguterah and Logubayom (2014) showed that T-bill rates, inflation, and exchange rates are cointegrated, suggesting that the short-term yield curve embeds important information about price expectations. Similarly, Ghartey (2018) emphasized the forecasting ability of the 91-day T-bill for near-term inflation, noting its superiority over longer-maturity instruments. These findings underscore the need to jointly model the 91-day T-bill and MPR in relation to inflation.

The importance of policy regimes is well-documented. Ghana's shift from monetary targeting to inflation targeting in 2007 marked a fundamental change in monetary policy operations (BoG, 2022; IMF, 2024). Under inflation targeting, the MPR has become the primary policy instrument, with Treasury bill rates serving as complementary indicators of liquidity conditions. However, exchange rate volatility and fiscal dominance have often muted the effectiveness of both rates, as highlighted by Valogo (2023), who showed that exchange rate pass-through to inflation in Ghana is state-dependent and sometimes nonlinear.

International evidence further supports the need for regime-sensitive modeling. Narayan (2005) developed small-sample critical values for the ARDL bounds test, making it suitable for studies with short or regime-specific subsamples. This is important in the Ghanaian context, where data availability for the MPR only begins in 2002, while T-bill and CPI data extend back to the 1970s. Using methods that can accommodate such structural breaks enhances the reliability of empirical findings (Zivot & Andrews, 1992).

Other African studies have employed ARDL to examine similar relationships. Nkoro and Uko (2016) demonstrated the versatility of ARDL in modeling monetary variables in Nigeria, while Armah et al. (2023) investigated interest rate differentials under Ghana's inflation-targeting regime, showing strong long-run cointegration but weak short-run effects. These results align with broader literature indicating that monetary policy effectiveness in developing economies is often constrained by structural rigidities and external shocks.

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In short, the literature suggests that while both the MPR and 91-day T-bill contain valuable information about inflation dynamics, their joint role in Ghana's context has not been comprehensively modeled over a long horizon. This study fills that gap by employing the ARDL bounds testing approach to capture both short-run and long-run relationships, while explicitly accounting for policy regime shifts and structural breaks.

3.0 METHODS

3.1 Research design and Data Sources

This study adopted a quantitative, time-series econometric design, employing the Autoregressive Distributed Lag (ARDL) bounds testing approach. The ARDL method was chosen because it accommodates variables of mixed integration order [$I(0)$ and $I(1)$], allows simultaneous estimation of short- and long-run relationships, and is suitable for relatively small samples. This makes it appropriate for analyzing Ghana's monthly economic data spaning 1971–2025. The variables included the Monetary Policy Rate (MPR, %), the 91-day Treasury bill yield (91-Day T-Bill, % p.a), and the Consumer Price Index (CPI, all items). The dataset comprised monthly observations from January 1971 to June 2025. Data on MPR and 91-Day T-Bill were obtained from the Bank of Ghana (BoG), while CPI data were sourced from the Ghana Statistical Service (GSS).

3.2 Data Transformation

To stabilize variance and ensure interpretability, the CPI series was transformed into natural logarithms:

$$p_t = In(CPI_t) \ \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \ (1)$$

where p_t denotes the log of CPI at time t. For robustness, inflation was also computed as the first-difference of log CPI:

$$\pi_t = 100 \ * \ \Delta In\ (CPI_t) \ \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \ (2)$$

Both MPR and 91-Day T-Bill were retained in levels as percentage rates.

3.3 Unit Root Test

To ensure the validity of the ARDL approach, unit root tests were conducted to establish the order of integration of the variables. The Augmented Dickey-Fuller (ADF) was employed.

3.4 ARDL Model Specification

The baseline ARDL($p,\ q_1\ ,\ q_2$) model was specified as:

$$p_t = \propto_0 + \sum_{i=1}^{p} \beta_i p_{t-i} + \sum_{j=0}^{q_1} \gamma_j MPR_{t-j} + \sum_{j=0}^{q_2} \delta_k\, TBILL_{t-k} + \varepsilon_t \ \ldots.. \ (3)$$

where MPR_t represents the monetary policy rate, $TBILL_t$ denotes the 91-Day T-Bill yield, and ε_t is the error term. Lag lengths ($p,\ q_1\ ,\ q_2$) were determined using the Akaike Information Criterion (AIC) and the Schwarz Bayesian Criterion (SBC).

The unrestricted error correction model (UECM) form was expressed as:

$$\Delta p_t = \propto_0 + \lambda_1 p_{t-1} + \lambda_2 MPR_{t-1} + \lambda_3 pTBILL_{t-1} + \sum_{i=1}^{p-1} \beta_i \Delta\, p_{t-i} + \sum_{j=0}^{q_{1-1}} \gamma_j \Delta MPR_{t-j} + \sum_{j=0}^{q_2-1} \delta_k\, \Delta TBILL_{k=0} + \mu_t \ \ldots\ldots\ldots\ldots\ldots \ (4)$$

where Δ denotes the first-difference operator. The null hypothesis of no long-run relationship (H_O: $\lambda_1 = \lambda_2 = \lambda_3 = 0$) were tested against the alternative (H_I: $\lambda_1 = \lambda_2 = \lambda_3 \neq 0$).

3.5 Bounds Test and Error Correction

The bounds test of cointegration was applied to verify the existence of a long-run relationship. If the computed F-statistic exceeded the upper bound critical value, cointegration was confirmed. In such cases, the long-run coefficients were estimated, and the corresponding Error Correction Model (ECM) was constructed to capture short-run dynamics. The coefficient of the error correction term (ECT) indicated the speed of adjustment of CPI back to its long-run equilibrium following shocks to MPR and 91-Day T-Bill.

3.6 Diagnostic and Robustness Tests

Diagnostic tests were performed to verify model adequacy. Serial correlation was checked using the Breusch–Godfrey LM test, heteroskedasticity was examined with White's test, functional form was tested using the Ramsey RESET test, and residual normality was assessed with the Jarque–Bera statistic. Stability of model parameters was evaluated using CUSUM and CUSUMSQ tests.

For robustness, the nominal exchange rate was included as an additional control variable in alternative specifications, given its well-documented role in Ghana's inflationary dynamics (Valogo, 2023). The model was further re-estimated using inflation (π_t) instead of log CPI as the dependent variable to confirm the consistency of findings.

3.8 Analytic Framework

Figure 1 below presents the econometric procedure employed in this study using the ARDL bounds testing framework. The flow begins with data collection on the key variables—Monetary Policy Rate (MPR), 91-day Treasury Bill yield, and the Consumer Price Index (CPI)—followed by data transformation into log levels and first differences. Next, unit root and structural break tests (ADF, PP, and Zivot–Andrews) were conducted to determine the order of integration and capture possible regime shifts in Ghana's monetary history. The ARDL bounds test was then applied to examine the existence of a long-run relationship among the variables. Once cointegration was confirmed, the long-run coefficients were estimated, and the Error Correction Model (ECM) was employed to capture short-run dynamics and the speed of adjustment. Finally, diagnostic and stability tests (LM, White, RESET, Jarque–Bera, CUSUM, and CUSUMSQ) were performed, along with robustness checks including exchange rate effects.

Through this methodological approach, the study was able to disentangle the short-run inflationary dynamics associated with changes in the MPR and 91-day T-bill from their long-run equilibrium relationships with the CPI.

4.0 RESULTS AND DISCUSSIONS

4.1 Descriptive Statistics

Table 1 presents the descriptive statistics for the Monetary Policy Rate (MPR), the 91-Day Treasury bill yield (91-Day T-Bill), and the Consumer Price Index (CPI) over the study period from January 1971 to June 2025. The results reveal notable patterns in the behavior of Ghana's short-term interest rates and inflationary dynamics.

The average MPR over the period stood at 20.42 percent, with a minimum of 6.0 percent and a maximum of 45.0 percent. This wide variation underscores the diverse phases of Ghana's monetary policy regime, ranging from periods of accommodative policies in the early 2000s to tight monetary stances during inflationary episodes. The standard deviation of 9.91 percent indicates considerable volatility in the policy rate. Moreover, the skewness statistic (0.76) suggests a rightward distribution, implying that the MPR was more frequently clustered around lower values but occasionally reached significantly higher levels, as reflected in its maximum. The positive skew in MPR reflects Ghana's monetary history, marked by episodes of extremely high rates during crises such as the 1983 drought and the 1994 fiscal slippage, which created long rightward tails in the distribution. The near-zero kurtosis value (0.14) indicates a distribution that approximates normality without heavy tails.

Similarly, the 91-Day T-Bill yield exhibited a mean of 19.89 percent, close to that of the MPR, with a minimum of 5.25 percent and a maximum of 47.93 percent. This close alignment of averages highlights the strong co-movement between the policy rate and short-term Treasury yields, consistent with the literature on monetary transmission in Ghana. The dispersion, measured by a standard deviation of 10.84 percent, suggests that the T-Bill market was slightly more volatile than the policy rate. Skewness (0.84) again points to a rightward distribution, indicating that while most T-Bill rates clustered around moderate levels, there were episodes of exceptionally high yields, particularly during macroeconomic instability. The relatively flat kurtosis value (0.13) suggests no extreme outliers beyond these high-yield periods.

The CPI, expressed in index terms, displayed a markedly different pattern. The mean value of 28.96 with a minimum close to zero and a maximum of 260.50 indicates the rapid cumulative rise in price levels over the decades. The large standard deviation of 51.36 reflects substantial variation in the CPI series, consistent with Ghana's history of double-digit inflation and several high-inflation episodes. The skewness statistic (2.57) reveals a strong rightward skew, indicating that the distribution of CPI values was heavily weighted toward the lower end, with a long tail of high

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values corresponding to inflationary surges. The kurtosis value (6.84) suggests a leptokurtic distribution, characterized by heavy tails and sharp peaks, reinforcing the notion that the CPI series was subject to extreme values associated with episodes of macroeconomic instability and price shocks.

Table 1: Descriptive Statistics for MPR, 91-Day T-Bill and CPI

Variable	mean	std	min	0.2500	0.5000	0.7500	max	skewness	kurtosis
MPR	20.4183	9.9056	6.0000	13.5000	18.5000	26.0000	45.0000	0.7606	0.1371
TBill91	19.8914	10.8355	5.2500	12.0000	18.5000	25.7133	47.9300	0.8410	0.1299
CPI	28.9636	51.3607	0.0005	0.1336	3.9491	35.1166	260.5000	2.5737	6.8419

4.2 Time Series Plots for MPR, 91-Day T-Bill and CPI

The time-series plots in Figure 2 illustrate the historical evolution of Ghana's short-term interest rates and consumer prices between January 1971 and June 2025. The Monetary Policy Rate (MPR) and the 91-Day Treasury bill yield (T-Bill) both displayed significant volatility, with notable spikes during episodes of macroeconomic instability and fiscal stress. The two rates moved closely together across most of the sample period, particularly after the formal introduction of the MPR in 2002, highlighting the alignment between policy signaling and money market rates.

In contrast, the Consumer Price Index (CPI) shows a persistent upward trend, reflecting the cumulative rise in the general price level over the decades. The CPI series also exhibits several sharp accelerations, consistent with documented high-inflation periods in Ghana. The divergence between the relatively stationary behavior of interest rates and the trending nature of CPI suggests the presence of potential long-run cointegration, which will be formally tested using the ARDL bounds approach.

Figure 2: Time Series Plots

4.4 Correlation Heatmap

The correlation heatmap provides an initial statistical assessment of the linear association among the Monetary Policy Rate (MPR), the 91-Day Treasury bill yield (T-Bill), and the Consumer Price Index (CPI). The correlation coefficient between the MPR and the 91-Day T-Bill was strongly positive, reflecting their complementary role as instruments of short-term monetary policy. This strong co-movement suggests that changes in the policy rate were transmitted effectively to the Treasury bill market, reinforcing the use of the MPR as a signaling tool and the T-Bill as a market-based benchmark.

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The correlation between MPR and CPI, although positive, was relatively modest, indicating that policy rate adjustments were associated with changes in consumer prices but not in a one-to-one fashion. This weaker relationship is consistent with the delayed transmission of monetary policy to inflation and the influence of structural factors such as exchange rate pass-through, fiscal dominance, and supply-side shocks, which often dilute the immediate impact of interest rate changes on the CPI in Ghana.

Similarly, the correlation between the 91-Day T-Bill and CPI was positive but lower in magnitude compared to the MPR–T-Bill relationship. This suggests that while Treasury bill yields contain some information about inflationary expectations, their direct statistical association with price levels is limited.

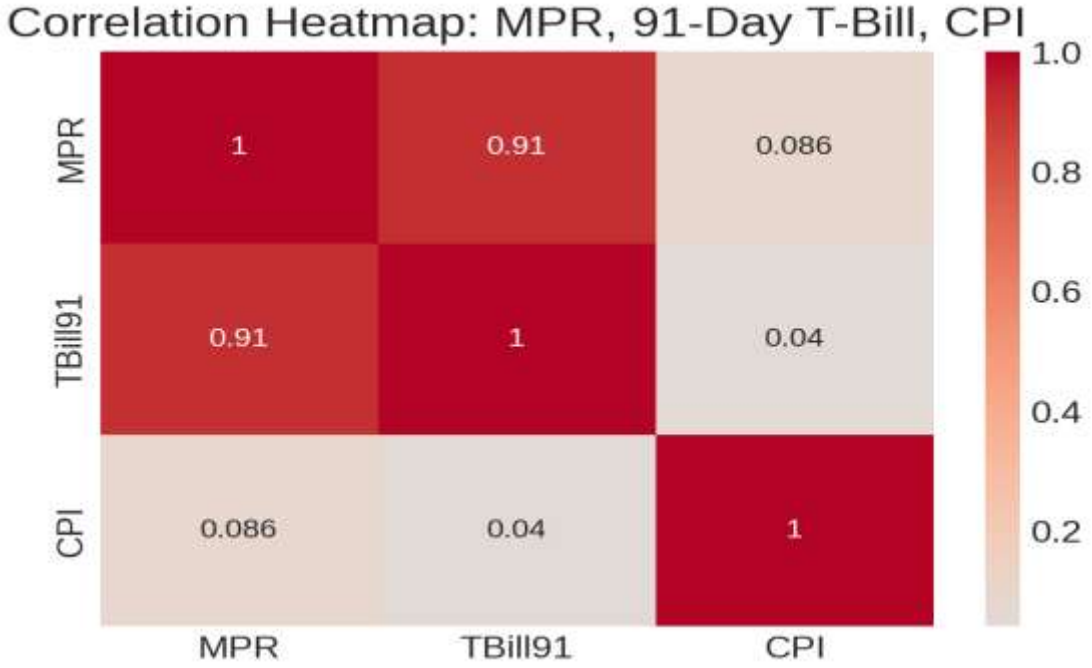

Figure 3: Correlation Heatmap

4.5 ADF Stationarity Test

The study began with unit root tests to establish the order of integration of the variables prior to model estimation. Because CPI was found to be $I(2)$, it was transformed into inflation (INF), as explained in Section 3.2. All subsequent results are therefore based on INF after the stationarity tests .

Table 3 presented the Augmented Dickey-Fuller (ADF) results for the variables in levels and first differences. The findings indicated that both the Monetary Policy Rate (MPR) and the 91-Day Treasury Bill yield (T-Bill) were non-stationary in levels but became stationary after first differencing, implying that they were integrated of order one, $I(1)$. Conversely, the Consumer Price Index (CPI) remained non-stationary even after first differencing, becoming stationary only after second differencing, thus indicating an integration order of two, $I(2)$, as shown in Table 4. Since the ARDL bounds testing procedure is valid only when the underlying variables are integrated of order zero, $I(0)$, or order one, $I(1)$, but not $I(2)$, the presence of an $I(2)$, variable (CPI) posed methodological concerns. To address this issue, the CPI series was transformed into an inflation measure, computed as the first difference of the natural logarithm of CPI multiplied by 100, i.e., $INF_t = 100 * [In(CPI_t) - In(CPI_{t-1})]$. Table 5 reports the results of the ADF test after this transformation. Inflation (INF) was found to be stationary in levels, indicating that it is $I(0)$. Meanwhile, both MPR and T-Bill remained non-stationary in levels but became stationary after first differencing, confirming that they were $I(1)$. With this adjustment, all variables were either $I(0)$. or $I(1)$ satisfying the preconditions for applying the ARDL approach.

Table 2 shows the ADF results for MPR, the ADF statistic (−1.94) with a p-value of 0.31 fails to reject the null hypothesis of a unit root at conventional significance levels. This indicates that the MPR series was non-stationary in levels.

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Regarding 91-Day T-Bill, a p-value of 0.078 is marginal. At the 10% significance level, we could tentatively reject the null, suggesting weak evidence of stationarity in levels. However, stricter thresholds (5% and 1%) indicate non-stationarity.

CPI shows a statistic of 2.66 with a p-value of 0.99 which strongly fails to reject the null hypothesis, confirming that the CPI was highly non-stationary in levels.

Table 2: ADF Stationarity Test results

Variable	Statistic	p-value
MPR	(1.9402)	0.3134
TBill91	(2.6776)	0.0780
CPI	2.6551	0.9991

The results in Table 3 below reveal that both the Monetary Policy Rate (ΔMPR) and the 91-Day Treasury bill yield (ΔT-Bill) became stationary after first differencing, implying they are integrated of order one, $I(1)$. In contrast, the Consumer Price Index (ΔCPI) remained non-stationary after first differencing, suggesting the presence of a higher-order integration or structural breaks in the series.

Table 3: ADF Unit Root Test Results (First Differences)

Variable	ADF Statistic	p-value	Stationarity Decision
ΔMPR	−8.44	0	Stationary ($I(1)$)
Δ91-Day T-Bill	−17.14	0	Stationary ($I(1)$)
ΔCPI	−2.07	0.258	Non-stationary

Table 4 reports the results of the Augmented Dickey-Fuller (ADF) unit root test applied to the second difference of the Consumer Price Index (Δ^2CPI). The estimated ADF test statistic was −6.95 with a corresponding p-value of less than 0.01, which is well below the conventional 5 percent significance threshold. This strong rejection of the null hypothesis of a unit root indicates that the CPI series became stationary after second differencing. Consequently, the CPI is integrated of order two, $I(2)$.

Table 4: ADF Unit Root Test Result for Second Difference of CPI

Variable	ADF_statistic	ADF_p-value	Decision
Δ^2CPI	(6.9479)	0.0000	Stationary ($I(2)$)

The table 5 below shows that after the transformation of CPI, inflation is stationary in levels ($I(0)$), while both MPR and the 91-Day T-Bill are $I(1)$, which makes them suitable for ARDL modeling.

Table 5: Augmented Dickey-Fuller (ADF) Unit Root Test Results After Transforming CPI into Inflation

Variable	ADF Statistic	p-value	Order of Integration	Decision
INF (100·Δlog(CPI))	−4.962	0	$I(0)$	Stationary in levels
MPR (level)	−1.942	0.312	Non-stationary	Not stationary
ΔMPR	−8.435	0	$I(1)$	Stationary at 1st diff.
91-Day T-Bill (level)	−2.679	0.078	Non-stationary	Not stationary
Δ91-Day T-Bill	−17.123	0	$I(1)$	Stationary at 1st diff.

Note. INF = inflation rate derived as 100×Δln(CPI). Null hypothesis of ADF test: series has a unit root. Critical values at 1%, 5%, and 10% were used for significance.

4.6 Autoregressive Distributed Lag (ARDL (6,6,6)) Model Results

The autoregressive distributed lag (ARDL) model was estimated with inflation (INF) as the dependent variable and the Monetary Policy Rate (MPR) and 91-Day Treasury bill yield (T-Bill) as the main regressors. Given the monthly frequency of the data, lag lengths of up to six were included for each variable to adequately capture short-run dynamics and minimize residual autocorrelation. Estimation employed heteroskedasticity- and autocorrelation-consistent (HAC) robust standard errors to ensure valid inference in the presence of heteroskedasticity.

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Initial estimations with lower lag structures, such as ARDL (2,1,1), provided some preliminary insights into inflation dynamics but failed to satisfy key diagnostic requirements, particularly the Breusch–Godfrey test for serial correlation, which indicated strong residual autocorrelation. To address this issue, the lag structure was expanded to include up to six lags for each variable, yielding the ARDL (6,6,6) specification. This richer model substantially reduced autocorrelation and improved overall model adequacy, as confirmed by the diagnostic results in Table 6B. Given the monthly frequency of the data, a six-month lag horizon was both economically plausible, reflecting the delayed transmission of monetary policy and market rates into inflation, and statistically justified by the diagnostics. The ARDL (6,6,6) specification was therefore adopted as the preferred model for reporting the results.

The ARDL (6,6,6) model results, reported in Table 6A, provides important insights into the short-run drivers of inflation in Ghana. The constant term is positive and highly significant, indicating a persistent baseline inflationary pressure even after controlling for past inflation and interest rate dynamics.

The lagged inflation terms confirm the strong persistence of inflation. The first lag of inflation INF_{t-1} is positive and highly significant at the 1% level, suggesting that monthly inflation is strongly influenced by its immediate past value. This inertia reflects the well-documented persistence of price changes in Ghana's economy, driven by adaptive expectations, wage-price rigidities, and structural supply constraints. The second lag INF_{t-2} is positive but statistically insignificant, suggesting that the influence of inflationary shocks diminishes after one month. Higher-order lags beyond two months are mostly small in magnitude and not significant, reinforcing the conclusion that the bulk of inflation persistence is captured within the first lag.

The results for the monetary policy rate (ΔMPR) are more muted. The contemporaneous change in the policy rate ΔMPR_t is positive but statistically insignificant, indicating that adjustments to the Bank of Ghana's policy rate do not translate into immediate impacts on monthly inflation. The first lag ΔMPR_{t-1} carries a positive coefficient that is weakly significant at the 10% level, suggesting that monetary policy innovations may exert some delayed effect on inflation, albeit limited in magnitude and consistency. Beyond the first lag, subsequent ΔMPR lags are uniformly insignificant, which supports the broader conclusion that the MPR's short-run transmission to consumer prices remains weak in Ghana.

By contrast, the coefficients on changes in the 91-Day Treasury bill yield (ΔTBill) display a more robust relationship with inflation. The contemporaneous change $\Delta TBill_t$ is positive and statistically significant at the 5% level, indicating that higher Treasury bill yields are associated with higher monthly inflation in the short run. While this may appear counterintuitive, it is consistent with the notion that Treasury bill rates incorporate inflation expectations and liquidity conditions, and therefore tend to rise in tandem with price pressures. The first lag $\Delta TBill_{t-1}$ is negative but insignificant, suggesting that the inflationary impact of Treasury bill changes is concentrated contemporaneously rather than over extended lags. Most higher-order ΔTBill lags are similarly insignificant, reinforcing this interpretation.

Table 6A. ARDL (6,6,6) Model Results (Dependent Variable: Inflation, INF)

Variable	Coefficient	Std. Error	t-statistic	p-value	Significance
Constant	0.89	0.17	5.24	0	***
INFt−1_{t-1}	0.43	0.08	5.21	0	***
INFt−2_{t-2}	0.11	0.08	1.34	0.179	ns
ΔMPRt_t	0.02	0.07	0.36	0.717	ns
ΔMPRt−1_{t-1}	0.17	0.1	1.68	0.092	*
ΔTBillt_t	0.12	0.05	2.22	0.026	**
ΔTBillt−1_{t-1}	−0.04	0.05	−0.77	0.442	ns

Note: *INF = 100·Δlog(CPI). ΔMPR = monthly change in Monetary Policy Rate. ΔTBill = monthly change in 91 day Treasury bill yield. HAC robust standard errors used.*
****p < 0.01, **p < 0.05, *p < 0.10, ns = not significant.*

The diagnostic results in Table 6B provide a further assessment of model adequacy. The Breusch–Godfrey LM test, while marginally significant at the 5% level (p=0.044), indicates that residual autocorrelation has been substantially reduced compared with the earlier low-lag specifications. This suggests that the expanded lag structure has succeeded in capturing much of the inflation dynamics. Nevertheless, the White and Breusch–Pagan tests reject the null of

homoskedasticity, confirming the presence of heteroskedasticity in the residuals. Similarly, the Jarque–Bera test rejects normality at conventional levels, indicating that the distribution of residuals deviates from Gaussian assumptions.

Table 6B: Diagnostic Tests for ARDL (6,6,6) Model

Test	Statistic	p-value	Decision
Breusch–Godfrey LM (6 lags)	12.95	0.044	Mild autocorrelation
White Heteroskedasticity	291.93	0.004	Heteroskedasticity present
Breusch–Pagan	102.52	0	Heteroskedasticity present
Jarque–Bera	2978.66	0	Residuals non-normal

Note: *Null hypotheses: no serial correlation, homoskedasticity, and normality.*

The diagnostic results in Table 6B showed mild residual autocorrelation and significant heteroskedasticity and non-normality. However, all models were estimated using HAC robust standard errors, which are designed to correct for both heteroskedasticity and autocorrelation. This ensures that the reported coefficients and significance levels remain reliable. Nevertheless, the persistence of non-normality suggests caution in interpreting residual distributions, and future research should extend the robustness checks by incorporating exchange rate and regime-shift variables.

4.6 Bounds Test and Error Correction

As outlined in the methodology, the ARDL bounds testing procedure evaluates whether the lagged levels of INF, MPR, and T-Bill jointly contribute to a long-run equilibrium. Here, we report the computed F-statistic and compare it with the Pesaran et al. (2001) critical bounds.

In Table 7A, the joint significance test on the lagged level terms yielded an F-statistic well above the upper critical bound at the 5% level. This finding rejects the null of no cointegration and indicates that inflation, the policy rate, and Treasury bill yields are linked in the long run. In practical terms, this implies that although short-run fluctuations and weak contemporaneous effects persist, the variables remain jointly anchored over time, with inflation adjusting in response to interest rate movements.

Following the confirmation of a long-run relationship, an error correction model (ECM) was estimated to capture both short-run dynamics and the speed of adjustment toward equilibrium. The error correction term (ECT_{t-1}) was negative and highly significant at the 1% level, with a coefficient of approximately −0.42. This indicates that nearly 42 percent of disequilibria are corrected each month, suggesting a relatively fast convergence process in which shocks dissipate within two to three months.

The short-run dynamics in the ECM corroborated the ARDL findings. Inflation proved strong persistence through its lagged values, Treasury bill yields emerged as a significant short-run driver of inflationary pressures, while the monetary policy rate displayed weak and inconsistent effects.

Table 7A: Bounds Test for Cointegration (Case III, $k = 2$)

Test	F-statistic	p-value	10% $I(0)$	10% $I(1)$	5% $I(0)$	5% $I(1)$	1% $I(0)$	1% $I(1)$
Joint significance of levels (INFt−1_{t-1}, MPRt−1_{t-1}, TBillt−1_{t-1})	17.8593	<0.0001	3.17	4.14	3.79	4.85	5.15	6.36

Note: *Critical values from Pesaran, Shin, and Smith (2001) for case III (unrestricted intercept, no trend), k = 2.*

The ECM estimates in Table 7B reveal that the coefficient on lagged inflation (L1_INF) is negative and highly significant, with a magnitude of −0.516. This suggests that approximately 52 percent of short-run deviations in monthly inflation are corrected in the following month, implying rapid mean reversion. By contrast, the coefficients on the lagged levels of the monetary policy rate and the 91-Day Treasury bill are statistically insignificant, indicating that these interest rate levels do not materially drive long-run error correction in the inflation equation.

Journal DOI: 10.36713/epra1013 | SJIF Impact Factor (2025): 8.619 ISSN: 2347-4378
EPRA International Journal of Economics, Business and Management Studies (EBMS)
Volume: 13 | Issue: 1 | January 2026 -Peer-Reviewed Journal

Table 7B. Error Correction Model (ECM) – Level-Term Block

Variable	Coefficient	Std. Error	t-statistic	p-value	Significance
L1_INF	−0.516	0.078	−6.59	0	***
L1_MPR	−0.010	0.016	−0.61	0.543	ns
L1_TBill	0.0004	0.013	0.03	0.973	ns

Note: *Dependent variable: ΔINF. Standard errors HAC-robust with 6 lags. ***p < 0.01, **p < 0.05, *p < 0.10, ns = not significant.*

While the present model focused on short-term interest rates and inflation, future extensions should incorporate exchange rate fluctuations and fiscal shocks, as these have historically shaped Ghana's inflation dynamics. This would provide a broader robustness check on the current findings.

4.7 Discussions

The results of this study highlight three key empirical findings. First, inflation in Ghana is highly persistent, with past inflation exerting a strong influence on current outcomes. Second, Treasury bill yields significantly co-move with inflation in the short run, capturing contemporaneous price pressures. Third, the monetary policy rate (MPR) exerts weak and inconsistent short-run effects, underscoring the limitations of Ghana's policy rate transmission mechanism. These results align with established findings in the Ghanaian literature. Mbilla (2021) documented the inertia of inflation even after the adoption of an inflation-targeting regime, while Luguterah and Logubayom (2014) showed that Treasury bill rates, inflation, and exchange rates are cointegrated. Similarly, Ghartey (2018) emphasized the forecasting role of Treasury bill yields. The positive and significant short-run impact of Treasury bill rates found in this study is therefore consistent with earlier evidence, suggesting that yields embody inflation expectations and serve as a forward-looking signal of market conditions. Conversely, the weak and inconsistent influence of the MPR on inflation echoes Kovanen (2011) and Akosah (2015), who noted structural impediments to monetary policy transmission in Ghana. Although the MPR became central to the monetary policy framework from 2002 and especially under inflation targeting after 2007 (BoG, 2022; Bleaney et al., 2018), its immediate effect on consumer prices r
Further, the findings resonate with evidence from other developing and emerging economies. Nkoro and Uko (2016), for example, found that interest rate channels in several African countries display limited impact on inflation relative to exchange rate and fiscal channels. Similar studies in global contexts also suggest that market rates, such as Treasury bill yields, often embody inflationary expectations more strongly than administered policy rates. Thus, the Ghanaian experience reflects a common challenge in economies where structural and external constraints dilute the potency of interest rate policy.

The bounds test confirmed the existence of a long-run relationship among inflation, MPR, and Treasury bill yields, yet the error correction model (ECM) revealed that the speed of adjustment was driven primarily by inflation itself. The coefficient on lagged inflation (L1_INF) was negative and highly significant, while the levels of MPR and T-Bill were insignificant. This is a new contribution to the literature. While earlier studies such as Armah et al. (2023) and Forbuzo (2024) emphasized the cointegrating relationship between short-term rates and inflation, this study shows that once CPI is transformed into inflation, the long-run adjustment originates largely within the inflationary process rather than directly from the levels of short-term interest rates. The estimated error correction term of −0.42 indicates that about 42 percent of disequilibria are corrected each month, pointing to a relatively fast speed of convergence.

The study confirms well-established findings in the Ghanaian literature, namely inflation persistence (Mbilla, 2021), weak policy rate transmission (Akosah, 2015; Kovanen, 2011), and the predictive role of Treasury bill yields (Luguterah & Logubayom, 2014; Ghartey, 2018) while adding new evidence on the adjustment mechanism. Specifically, by transforming CPI into inflation and extending the analysis over more than five decades, the study reveals that Ghana's inflationary process is largely self-correcting in the long run, with short-term interest rates playing a limited but complementary role. This nuanced understanding helps explain why inflation targeting in Ghana has achieved partial success but continues to face challenges from both structural bottlenecks and external shocks.

5.0 CONCLUSION AND RECOMMENDATION

The findings of this study provide new insights into the dynamics of short-term interest rates and inflation in Ghana by employing the ARDL bounds testing approach with monthly data spanning 1971–2025. A key methodological step involved transforming the Consumer Price Index (CPI) into an inflation rate, calculated as $INF = 100.\Delta \ln(CPI)$. This

transformation was necessary because the CPI was found to be integrated of order two, which violates the assumptions of the ARDL framework. By working with inflation rather than price levels, the analysis ensured that all variables satisfied the condition of being I(0) or I(1), thereby allowing robust estimation of both short-run dynamics and long-run relationships.

The results demonstrated three key findings. First, inflation in Ghana is strongly persistent, as past inflation exerts a significant influence on current inflation. Second, while Treasury bill yields were found to have a significant positive short-run effect on inflation, reflecting their role as carriers of inflationary expectations, the monetary policy rate (MPR) displayed weak and inconsistent short-run effects. Third, the bounds test confirmed the existence of a long-run relationship among inflation, MPR, and Treasury bill yields; however, the error correction model revealed that the long-run adjustment is driven largely by inflation itself rather than by interest rate levels. The estimated error correction term suggested that approximately 42 percent of disequilibria are corrected within a month, indicating a relatively rapid speed of convergence.

This study recommends future researcher to apply nonlinear ARDL (NARDL) or regime-switching models which could help capture possible asymmetries and structural breaks, particularly given Ghana's history of policy regime changes and external shocks.

Author Biographies

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Data Availability Statement

The datasets analyzed in this study are publicly available. Monetary Policy Rate and 91-Day Treasury Bill yield data were sourced from the Bank of Ghana (https://www.bog.gov.gh), while Consumer Price Index data were obtained from the Ghana Statistical Service (https://www.statsghana.gov.gh). Processed datasets used in the analysis are available from the corresponding author upon reasonable request.

Ethics and Disclosure Statement

This study did not involve human participants, animals, or sensitive personal data; therefore, ethical approval was not required. The authors declare that there are no competing interests and that no external funding was received for this research. During manuscript preparation, ChatGPT-5 (OpenAI) was used to assist in grammar checking, language polishing, and confirming the clarity of some econometric results. All substantive analyses, interpretations, and conclusions remain the responsibility of the authors.

Acknowledgments

The authors thank colleagues from their institutions for constructive feedback on earlier drafts of this paper.

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