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Modeling Inflation Dynamics in a Small Open Economy: An ARDL Analysis of Macroeconomic Transmission Mechanisms and Structural Breaks in Nepal

Goma Bhattarai[1] , Prashanna Neupane[1] & Arju Marasini[1]*

[1]Lumbini Banijya Campus, Devinagar, Butwal, Nepal
*Corresponding Author: gomab.hattarai583@gmail.com

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Abstract

Background: In recent years, many countries, including Nepal have been dealing with continual inflation, largely driven by disruptions in the global supply chain, fluctuations in exchange rates, and domestic structural bottlenecks. As a small open economy with a fixed exchange rate regime and a high dependence on imports, Nepal is particularly vulnerable to external price shocks and policy shifts in its trading partners. At the same time, there is still considerable debate about the extent to which domestic monetary conditions, real sector dynamics, and financial market developments influence Nepal's inflation pattern, as well as the extent to which structural breaks, such as economic and financial crises, have changed these underlying relationships.

Purpose: This study measures the determinants of inflation in Nepal with empirical testing. This paper investigates a critical gap by incorporating a structural break into the ARDL approach, which previous studies have overlooked.

Design/methodology/approach: The study incorporates annual time-series data from 1994 to 2024 for Nepal and employs an ARDL model with a structural dummy. Unit root, Chow breakpoint, diagnostic, and Granger causality tests ensure model's robustness.

Findings: The results indicate that there is long-run co-integration among inflation, the exchange rate, and GDP. Exchange rate depreciation significantly drives inflation with a lag, while GDP growth exerts dual effects: short-run moderation but long-run inflationary pressure. Structural breaks have a significant impact on inflationary dynamics, although financial indicators remain insignificant.

Conclusion: Nepal's inflation is simultaneously formed by monetary expansion, fiscal deficit, structural bottlenecks, and exchange rate pass-through. Policy integrity demands inflation targeting, fiscal discipline, and structural reforms to mitigate weakness.

Keywords - ARDL Bound Testing, Exchange Rate, Fiscal Deficits, Inflation Dynamics, Structural Break.

1. Introduction

Inflation dynamics have recently resurfaced as a global emerging issue. After a period of relative price stability, inflation rose multi-decade worldwide during the years 2021-2022, backed by pandemic-related supply shocks and price spikes (Dao et al., 2024). This global inflation signal highlighted the interlinked nature of the modern economies. According to research, inflation is becoming a more universal phenomenon, with a common factor accounting for approximately 70% of the variation in inflation among developed nations (Ciccarelli & Mojon, 2010). Rapid and unstable inflation poses significant risks to macroeconomic stability, reducing purchasing power and complicating growth prospects. Thus, understanding inflation dynamics is of preponderant importance for policymakers around the world. In the context of developing and small open economies, these economies face unique challenges in controlling inflation. South Asian economies, in particular, have experienced continuous price inflation pressures due to structural blockage and external weaknesses. Nepal offers a remarkable case as a small open economy closely bound to its larger neighbouring countries Nepal's inflation tends to align closely with regional dynamics, most notably those of India, and is likewise shaped by broader fluctuations in global commodity markets. Nepal's currency is closely tied to the Indian rupee, effectively importing India's monetary viewpoint (Suzuki, 2019). Consequently, Indian inflation has a strong influence on Nepalese prices, with a one-for-one correlation in some periods (Ginting, 2007).

Nepal's consumer prices have shown marked sensitivity to supply-side shocks. Inflation increased rapidly by approximately 21% in 1992, primarily due to rapid increases in basic food import prices from India (Paudel & Raut, 2022). Furthermore, inflation remained steadily increased, exceeding 6% throughout the 2010s, which is above the estimated optimal threshold of 6–6.4% (Timsina et al., 2017). And higher than the 6 % growth-slowing threshold identified in Nepal (Bhusal & Silpakar, 2012). These patterns suggest that external transmission mechanisms and structural factors may constrain the effectiveness of conventional demand-management policies in Nepal. Maintaining price stability has long been a critical policy priority in Nepal, and the issue is multifaceted. Earlier studies and policy reviews have highlighted remarkable gaps in the policy system. The Nepal Rastra Bank has traditionally targeted monetary aggregates rather than directly targeting inflation, and there is no formal inflation-targeting system in place. Nepal's fixed exchange rate with India constrains independent monetary policy, essentially outsourcing inflation control to India's policies (Suzuki, 2019). Similarly, Humagai (2023) has focused on a single variable using a basic method, which narrows prior studies on Nepal's inflation. The fiscal policy has sometimes been pro-cyclical, with imbalanced financing likely to add to demand-pull inflation (Adhikari et al., 2024).

Additionally, systemic problems such as heavy dependence on imports (including fuel and food), supply-chain constraints, and productivity gaps lead to cost-push inflation, which monetary policy alone struggles to control (Ghimire & Paudel, 2025). Earlier works on Nepal or similar economies often focused on either monetary factors or simple Phillips curve relationships, without accounting for structural breaks or the full pass-through mechanisms in a cointegrated system. Inflation in Nepal continues to pose a notable macroeconomic challenge, resulting in declining household real incomes, misinformed investments, and weakening financial stability.

Recent studies on Nepal and similar economies continue to examine inflation primarily through a stable time-series lens. They focus on money, output, and external prices, but usually treat policy shifts and crises only informally and do not model structural breaks in the inflation process. Recent Nepali and regional ARDL studies have separated long-run and short-run effects, yet they rarely combine monetary, external, fiscal, and financial channels within a single framework with explicit break tests (Jackson et al., 2023; Feyisa, 2024; Poudel et al., 2024). This research employs the ARDL bounds testing approach, which is uniquely capable of estimating both short-run fluctuations and long-run equilibrium relationships in small samples and with mixed incorporation orders.

Using ARDL analysis, a study found that Nepal's inflation is influenced in the long run by Indian inflation, real income, and exchange rate, and in the short run by Indian inflation, exchange rate, and government

spending (Byanjankar, 2020; Neupane, 2022). However, that study does not account for discrete structural breaks or shifts in policy regimes, such as post-2000 financial liberalization or the COVID-19 shock, events that are likely to alter the inflation transmission process. Although the ARDL framework has been employed in studies of Nepal's inflation dynamics, no published work has yet explicitly integrated structural or regime shifts within this framework. This omission is critical because neglecting structural breaks stemming from economic liberalization, institutional reform, or external shocks risks missing specified models and invalidating policy findings. This research employs the ARDL bounds testing approach, which is uniquely capable of estimating both short-run fluctuations and long-run equilibrium relationships in small samples and with mixed incorporation orders. It incorporates structural break tests, paired with appropriate dummy variables, and offers both scholarly insight and practical value for policy formulation. By bringing together monetary, real, external, and structural variables with a structural-break specification, this study aims to determine whether imported cost shocks, domestic demand pressures, or monetary expansion are the primary sources of inflation in Nepal during the post-liberalization period. Clear evidence in these channels is important because central banks in developing economies now design inflation targeting, exchange rate, and communication strategies based on detailed diagnostics of inflation drivers, and Nepal Rastra Bank has also stressed the need for such empirical support when coordinating monetary and fiscal policy (Ha et al., 2018; Nkoro & Uko, 2016).

2. Literature Review

Theoretical Review

Economic theory offers various lenses for interpreting inflation in small open economies. Classical and monetarist theories highlight the role of money supply. The Classical Quantity Theory points that inflation indicates extreme money growth relative to output (Dimand, 2013). Monetarists similarly declare that "inflation is always and everywhere a monetary phenomenon," persistent due to excessive liquidity (Friedman, 1968; Friedman, 1977). According to this theory, Nepal's ongoing inflation would result from the fast expansion of broad money (M2) relative to real GDP (Shrestha & Timilsina, 2025).

Keynesian/demand-pull models place a strong emphasis on fiscal policy and aggregate demand, where total spending surpasses productive capacity. As a result, demand-pull inflation occurs, leading to budget deficits. If the economy is operating at or near full capacity, excessive government spending can fuel inflation (Keynes, 1937; Phelps, 1967; Blinder & Solow, 1973). A stock-flow stable model posits that fiscal policy exacerbates inflationary dynamics in small open economies when demand exceeds output capacity (Raza et al., 2023). Inflation is directly associated to large fiscal deficits, especially in developing countries (Gilchrist et al., 2005). Additionally, recent research shows that in African nations with less developed financial markets, fiscal deficits can lead to demand-pull inflation (Aragaw, 2024). In line with Keynesian demand-side pressure, Nepal's budget deficits have caused inflation to rise sharply (Paudel, 2005).

In Nepal, inflation is driven by an open economy framework or external forces. Structuralist approaches indicate that supply-side factors such as agricultural shortages, infrastructure bottlenecks, and a heavy reliance on imports, rather than just excess demand, are repeatedly the cause of ongoing inflation in developing economies (Olivera, 1964; Canavese, 1982). Such real-side bottlenecks can derive and maintain inflationary pressure, according to the latest cross-country evidence consistent with the Structuralist viewpoint (Kim, 2023). The rise in global oil prices leads to increased domestic prices in South Asian markets, resulting in cost-push inflation from imported energy and inputs (Zakaria et al., 2021). Exchange rate depreciation has a significant impact on consumer prices (Lama et al., 2025), a process embedded in the ERPT framework (Nasir et al., 2020). The Nepalese currency is aligned to the Indian one, which makes imported inflation from India a major and cointegrated factor (Nepal & Nepal, 2010; Ginting, 2007). Inflation is closely linked to supply shocks, including the volatility of petroleum prices, agricultural disruptions, and infrastructure limitations, particularly in Nepal. Thus, this highlights the importance of

structural bottlenecks in a small, open economy country like Nepal (Shrestha & Timilsina, 2025). To summarize, the fiscal deficit is enhanced by a bi-directional relationship with inflation, showing fiscal dominance risks (Adhikari et al., 2024).

Empirical Review

Cross-country research confirms that inflation has strong international elements. Ciccarelli & Mojon (2010) demonstrate that about 70% of inflation variance in advanced economies is explained by a common global factor. They find national inflation rates move strongly over time, with a robust error-correction framework leading them toward a global inflation trend. Recent studies on the 2020-2022 growth period also highlight global shocks. According to Dao et al. (2024), inflation in 21 countries indicates that the post-2020 energy and food price shocks have mostly influenced the rise and fall of headline inflation. They argue the domestic output gaps played only a secondary role; rather, supply chain disruptions and commodity shocks passed through into core inflation. These results highlight that in an interrelated world, external price shocks (such as oil, food, and supply bottlenecks) can significantly influence domestic inflation dynamics.

Global empirical work also underscores systems of transmission. Studies of exchange-rate pass-through reveal wide variation across countries, but typically show that import prices have a significant influence on consumer inflation. Sabu and Ramachandran (2025) find that exchange rate fluctuations raise inflation expectations for small economies even when inflation targeting is in place. For India, household expectations fluctuate in tandem with real exchange rate fluctuations, resulting in documented disparities. Moreover, Carrière-Swallow et al. (2024) state that the inflationary impulse of depreciation is likely to be stronger when inflation is already high, consistent with state-dependent pass-through. These studies show that Nepal, with a high import content and a fixed peg, is vulnerable to imported inflation whenever the Indian rupee itself changes, or Indian prices increase. Similarly, studies on fiscal stability suggest that countries with repeated fiscal financing tend to experience higher inflation and volatility, a phenomenon not specific to Nepal. Salma et al. (2025) identify that in South Asia, political stability and sound fiscal policies correlate with lower inflation. Countries with greater policy uncertainty or high government consumption tend to have higher inflation. These global and regional findings establish a framework, pointing to common forces and underscoring that sophisticated inflation analysis must account for cross-border channels and policy regimes. Recent studies on developing and small open countries have begun drawing upon modern time series methods to analyse inflation. Using an ARDL and a dynamic-ARDL approach for countries like Ethiopia and Algeria, it was found that money supply, exchange rates, and prices of imports are the main long-run influences of inflation, while a weaker inflation in the short run is the result of the greater impact of supply shocks (Feyisa, 2024; Tolasa et al., 2022). Similarly, South Asian countries using panel co-integration and panel ARDL methodologies also show that inflation is not only influenced by a simple relationship between money supply and outcome, but also by some external vulnerabilities and structural factors, particularly those related to human development financially and in depth (Islam, 2021). Recent ARDL and VECM-based studies for Nepal have demonstrated that Indian inflation and domestic monetary and fiscal conditions significantly influence prices. Yet, despite these insights, the inflation process is still largely modeled as linear and time-invariant (Chhetri, 2023).

Ahmad et al. (2024) stated that rising global oil prices drive inflation in South Asian countries, despite any technological advancements. South Asian countries show both similarities and diversity in inflation determinants. Latest panel studies define similar forces across the region. Khan and Saqib (2011) show that political instability raises inflation, implying that greater stability weakens it, across Asian economies, including Bangladesh, Pakistan, and Sri Lanka. As stated by Nguyen (2015), fiscal deficits and government expenditure are significant long-term factors contributing to inflation in Sri Lanka and India. Enhanced government expenditure shows a positive and long-term correlation with inflation (Shifaniya et al., 2022; Srivastava et al., 2024). Similarly, they also recognize the increase in broad money and the growth of GDP,

which encompasses inflation and ensures the balance of supply and demand; even so, growth in domestic credit is inflationary. Hence, the implication is that reasonable fiscal policy and a stable government can manage inflation in the region.

In addition, according to Crump et al. (2024), price pressures increase, and the Phillips-curve mechanism shifts to the cost side when labour markets are tight, and the unemployment gap is negative. Renkin et al. (2020) find that wage increases resulting from minimum wage increases are passed through to retail prices. Bijnens et al. (2023) provide firm-level evidence that rising wages contribute to persistent price increases in Belgium, characterized by wage-driven cost-push inflation. In sum, South Asian practical studies that consider commodity prices, technological change, and labour conditions play crucial roles, in addition to standard demand elements. Despite being comparatively sparse, Nepal's literature largely reinforces regional themes because the Nepalese rupee is pegged to the Indian rupee, effectively importing India's monetary stance. Studies document long-run co-integration and substantial pass-through from Indian to Nepalese inflation (Suzuki, 2019; Nepal & Nepal, 2010; Ginting, 2007). Nepal and Nepal (2010) estimate that about two-thirds of Nepal's inflation is attributable to India's inflation, while the IMF reports an elasticity of 0.45 (Ginting, 2007).

Recent studies in Nepal also find that money supply expansion is inflationary in the long run. Shrestha and Timilsina (2025) report a positive long run elasticity of Nepal's CPI to Indian prices (0.64) alongside significance monetary effects, output gains tend to moderate inflation, with agriculture particularly important in Nepal's CPI basket; Ghimire and Paudel (2025) find Indian CPI (0.40), remittances (0.10) and broad money (0.14) significantly raise inflation, and Adhikari et al. (2024) confirm M2 as a key determinant in a VECM. Additionally, an ERPT study in Nepal reveals significant and persistent pass-through to CPI for up to a year, with asymmetries such as depreciation mattering more, which reinforces the imported-inflation channel under the peg (Lama et al., 2025). Moreover, non-linear growth effects indicate that inflation supports growth up to an estimated threshold of approximately 6.4, beyond which it becomes growth-reducing (Paudel & Raut, 2022). Similarly, ERPT and global commodity shocks are significant due to Nepal's reliance on imports. Likewise, Ghimire and Poudel (2025) also highlight that remittances have a positive impact on inflation through demand. Most Nepal studies estimate ARDL/co-integration or VECM without jointly modeling all channels or allowing for multiple structural breaks (such as policy/regime shifts). This motivates the use of the ARDL framework with break tests in this paper.

Taken together, these studies offer useful evidence, but they also share some limitations. Most of them focus either on monetary and fiscal variables or on external prices, and do not jointly model financial market channels or explicit regime shifts such as crises and policy breaks. Methods like ARDL, panel co-integration, and VECM parameters are generally examined without formal structural break tests. Therefore, possible changes in transmission mechanisms are recorded in the error term rather than being identified (Saji et al., 2024). In addition, many developing country applications rely on relatively short samples or low-frequency data, which restricts their ability to capture non-linear dynamics and changing policy frameworks over time (Chhetri, 2023). These gaps motivate a framework that combines ARD with structural-break analysis for a small open economy like Nepal.

3. Methodology

This research employs an Autoregressive Distributed Lag (ARDL) model, specifically ARDL (1,1,1,0,0,1), calculated using annual data from 1994 to 2024 (Pesaran et al., 2001). The dependent variable is the customer price index (CPI), which measures inflation in developing economies and is directly relevant for central bank policy decisions (Anand et al., 2015; Shaban et al., 2019). Explanatory variables are selected to indicate the major transmission channels examined in theory and in the Nepalese context. The nominal exchange rate represents imported inflation and exchange-rate pass-through, which is generally strong in small open economies (Boug et al., 2005). Real gross domestic product (RGDP) represents overall demand pressure and supply capacity. Global evidence shows that real activity is closely linked

with inflation dynamics in emerging and developing economies (Ha et al., 2018). The NEPSE index in log form (LN_NEP) and the stock market turnover ratio (TR) proxy financial market conditions and liquidity, since Nepalese stock prices and trading activity react to macroeconomic fundamentals such as interest rates, money supply, and output (Panta, 2020; Devkota & Dhungana, 2020; Pokharel, 2020).

The ARDL approach is suitable because the variables are a mixture of I(0) and I(1), and the sample size is relatively small. ARDL models accommodate mixed integration orders and enable the estimation of both short-run and long-run equilibria within a single equation framework (Nkoro & Uko, 2016). Maximum lags of two were first allowed for each variable, and the final specification ARDL (1,1,1,0,0,1) was chosen by an automatic lag-selection procedure using the Akaike Information Criterion (AIC). This means one lag of CPI, one lag each for LN_EXC and LN_GDP, no additional lags for LN_NEP and TR, one lag for the structural dummy (Pesaran et al., 2001)

To address structural change, a dummy variable (D) is introduced for the 2011 NEPSE crisis, when the index hit a historical low and regulatory actions tightened liquidity. Structural breaks of this type can distort co-integration tests and bias long-run coefficients if they are not explicitly modelled (Beyer et al., 2009; Doguwa et al., 2014). Including D in the ARDL (1,1,1,0,0,1) specification lets the model capture the one-time regime shift in the inflation process associated with the crisis, while still preserving a stable long-run relationship among inflation, exchange rate, output, and financial variables (Pesaran et al., 2001; Baral & Katuwal, 2024; Shrestha & Subedi, 2014) as shown below.

i. Theoretical Functional Form

$$CPIt=f(\ln(EXCt),\ln(GDPt),\ln(NEPt),TRt,Dt$$

ii. ARDL Functional Form with lags

$$CPI_t=\alpha_0+\alpha_1 CPI_{t-1}+\beta_0 \ln EXC_t+\beta_1 \ln EXC_{t-1}+\gamma_0 \ln(GDP_t+\gamma_1 \ln(GDP_{t-1}+\delta_0 \ln(NEP_t+\lambda_0 TR_t+\theta_0 D_t+\theta_1 D_{t-1}+u_t\cdot$$

iii. Long-run Functional Form

$$CPI_t = g(\ln(EXC_t, \ln GDP_t, \ln NEP_t, TR_t, D_t)$$

iv. Error-Correction Model Form

$$\Delta CPI_t = \phi 0 + \phi_1 \Delta \ln EXC_t + \phi_2 \Delta \ln GDP_t + \phi_3 \Delta D_t + \lambda ECTt-1+\varepsilon t.$$

Where, $\phi 1,\phi 2,\phi 3$ = short-run coefficients

$\lambda\lambda$ = speed of adjustment (should be negative and significant)

ECT_{t-1} = lagged error-correction term from the long-run relationship

As of i, ii, iii, and iv functional forms, in this study, inflation in Nepal is first modeled in a general way, where CPIt is a function of key macroeconomic and structural factors, such as the exchange rate, real GDP, stock market variables, financial turnover, and a structural-break dummy. This general relationship is then operationalised using an ARDL(1,1,1,0,0,1) framework, which incorporates lagged values to capture inflation inertia and delayed transmission of shocks. Given evidence of co-integration, the model implies a long-run functional form that describes the equilibrium relationship between inflation and its determinants. Finally, the ARDL is reparameterized into an error–correction model (ECM), which clearly separates short-run effects from the speed at which deviations from the long-run equilibrium are corrected over time, as shown above.

4. Result and Analysis

This study uses the CPI as the dependent variable, with LN_EXC, LN_GDP, LN_NEP, TR, and a Dummy Variable (2011 NEPSE crisis) as regressors, using annual data from 1994 to 2024. The Chow test was implied to detect a structural break. Similarly, descriptive statistics show an average inflation of 6.8% with variation across the periods. The unit root test confirms a mixed integration order, so the ARDL approach

was implemented, followed by diagnostic tests to assess the link direction. Granger causality was then examined to determine the direction of the link.

Note: CPI: Consumer Price Index, LN_EXC = LN_EXCHANGE, LN_GDP = LN_GROSS_DOMESTIC_ PRODUCT, TR = TURNOVER_RATIO, D = DUMMY.

Table 1: Chow Breakpoint Test (2011- NEPSE Crisis)

Test Statistic	Value	Prob.	Decision (5% level)
F-statistic	2.3189	0.0796	Not significant (10% level)
Log likelihood ratio	13.6281	0.0182	Significant - Break detected
Wald Statistic	11.5944	0.0408	Significant - Break detected

The Chow test from Table 1 rejects the null hypothesis of no structural break in 2011 based on the LR and Wald statistics, confirming a regime shift linked to the NEPSE crisis. Therefore, a dummy variable for 2011 is included in the ARDL model (Chow, 1960).

4.1 Descriptive Statistics

The descriptive statistics in Table 2 are drawn from a 31-year sample of the Nepalese economy, which shows distinct behavioral patterns essential for modeling inflation.

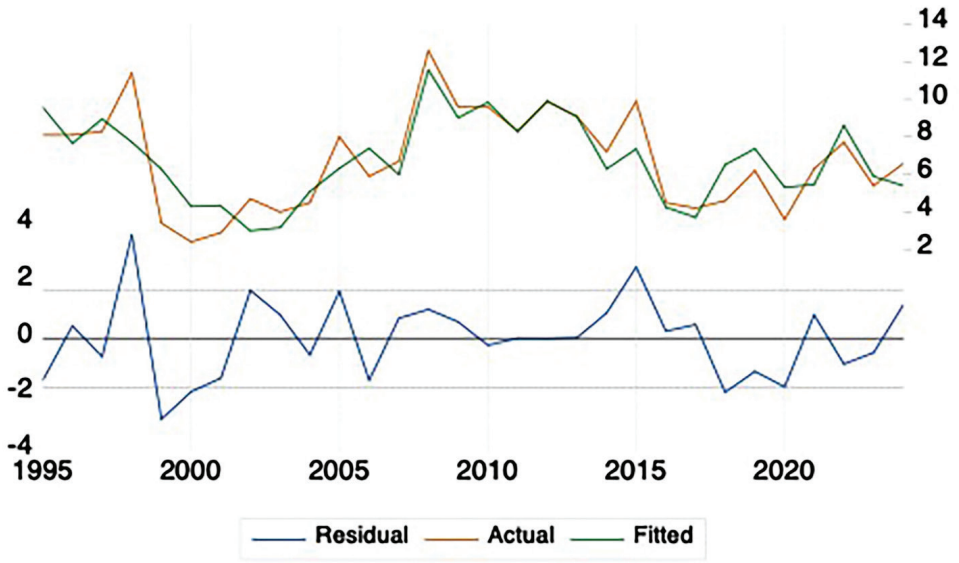
Table 2: Descriptive Statistics

	CPI	LN_EXC	LN_GDP	LN_NEP	TR	D
Mean	6.819032	4.436699	7.321179	6.335219	0.046123	0.451613
Median	6.700000	4.342246	7.318297	6.169046	0.006579	0.000000
Maximum	12.60000	4.920346	7.936507	7.966729	0.418946	1.000000
Minimum	2.400000	3.910822	6.690927	5.095895	0.001556	0.000000
Std. Dev.	2.584008	0.277321	0.379200	0.901616	0.102754	0.505879
Skewness	0.209915	0.149829	0.030744	0.230615	2.725832	0.194461
Kurtosis	0.303089	2.0000383	1.767544	1.668062	9.334119	1.037815
Jarque-Bera	0.855009	1.406664	1.966858	2.566274	90.21219	5.168514
Probability	0.652134	0.494933	0.374026	0.277166	0.000000	0.075452
Sum	211.3900	137.5377	226.9566	196.3918	1.429814	14.00000
Sum Sq. Dev.	200.3129	2.307212	4.313789	24.38734	0.316754	7.677419
Observations	31	31	31	31	31	31

In Table 2, the dependent variable, inflation, shows considerable volatility with a mean of almost 6.81%, highlighting periods of both stability and sharp price movements. The exchange rate and GDP display stable growth trends, whereas the stock market index exhibits higher volatility, a characteristic of emerging financial markets. Notably, the dummy variable constructed to capture the post-structural break regime shows a mean of 0.45, highlighting that the distinct economic period accounts for 45% of the observations in the sample. This thereby provides a balanced analytical distribution for robust comparative analysis within the ARDL framework.

The graph from Figure 1 shows the model's strong performance in tracking Nepal's inflation dynamics. The close alignment between the actual and fitted values indicates that the model effectively captures the observed trends in the data.

Figure 1: Actual, Fitted Residual Graph



Crucially, in Figure 1, the residuals appear to be randomly distributed around zero, without displaying any systematic trend or pattern, indicating the model's specification and the reliability of its parameters.

4.2 Unit Root Test

A unit root test is used to determine whether a variable is stationary or non-stationary. Similarly, the Augmented Dickey-Fuller test was utilized to check the stationarity of the variable (Dickey & Fuller, 1979).

Table 3: Augmented Dickey-Fuller (ADF) Test

Variable	Level ADF p-value	1st Difference ADF p-value	Order I(d)	*Residual Results of ARDL Estimation
CPI	0.0316	0.0000	I(0)	-
LN_EXC	0.7942	0.0001	I(1)	-
LN_GDP	0.9009	0.0000	I(1)	-
LN_NEP	0.8509	0.0010	I(1)	-
TR	0.9907	0.0000	I(1)	-
Dummy	Dropped From Test			
*Residual ARDL	0.0000		I(0)	R2=0.5588, DW=1.98; highlighting long-run co-integration relationship.

There is a mix of I(0) and I(1) in Table 3, which validates the implication of the ARDL approach. Similarly, the residual of the ARDL estimation is stationary at the level, highlighting the long-run cointegrating equilibrium (Pesaran et al., 2001).

4.3 ARDL Model Estimation

The Table 4 study employs an ARDL model to identify the key determinants of inflation in Nepal, confirming the significant structural break and revealing that inflationary dynamics are primarily driven by persistent inertia and lagged macroeconomic transmissions rather than shocks.

Table 4: ARDL Estimations Output

Variable	Coefficient	Std. Error	t-Statistics	Prob.*
CPI	0.354310	0.141135	2.510426	0.0208
LN_EXC	11.74582	8.092518	1.451442	0.1622
LN_EXC (-1)	-30.21439	7.090319	-4.261358	0.0004
LN_GDP	-20.51297	17.39111	-1.179509	0.2520
LN_GDP (-1)	35.12331	16.37978	2.144308	0.0445
LN_NEP	-0.813962	1.165150	-0.698590	0.4929
TR	3.522564	3.842285	0.916789	0.3702
D	-4.297958	2.423868	-1.773181	0.0914
D (-1)	3.715841	2.192506	1.694792	0.1056
C	-14.78333	22.48383	-0.657510	0.5183

Model Fit and Diagnostics

The model explains that R-squared equals 0.6999, accounting for 70.99% of the variation in inflation, indicating strong explanatory power. The F-statistic of 5.18, with a p-value of 0.0010, confirms the overall model's significance. Moreover, the Durbin-Watson statistic of 2.15 suggests that there is no major problem of autocorrelation, ensuring model robustness (Durbin & Watson, 1951).

In Table 4, the model explains 69.99% of the inflation variation, indicating a robust delayed exchange rate pass-through effect, where currency depreciation significantly raises domestic prices after a one-year lag, whereas economic growth suppresses inflation with a similar time lag. Critically, the dummy variable captured a structural shift that is linked to major socio-economic events, which permanently altered the inflation process. However, financial market variables were found to be statistically insignificant, which necessitates a forward-looking monetary policy framework for Nepal's central bank.

The graph from Figure 2 shows the recursive residual over time. The major part is that the residual fluctuates randomly without showing any trend or pattern.

Figure 2: Residual Plot from ARDL Model Estimations

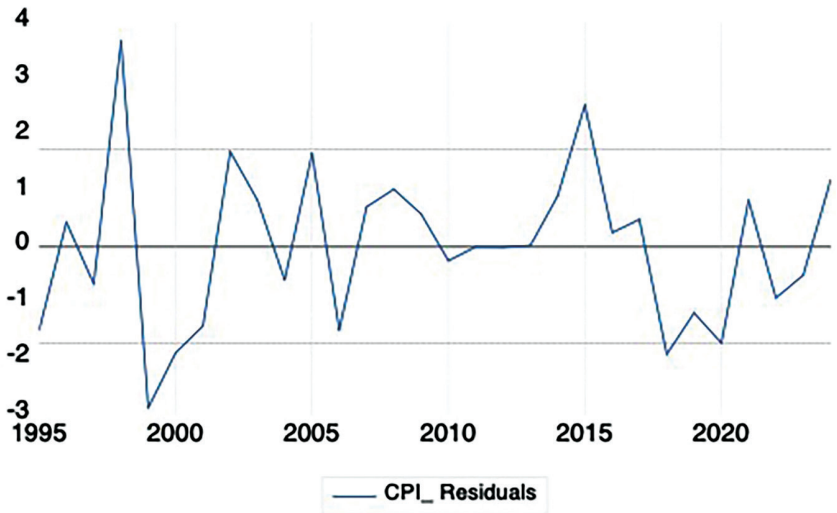


Figure 2 indicates that residuals are well-behaved and do not show any evidence of structural instability or model breakdown throughout the period. The model's parameters appear to have remained consistent over time.

The results from Table 5 highlight the F-bounds test statistics of 4.6996, which exceeds the 5% significance level at 3.38.

Table 5: Co-integration Test

Test Stat.	Value
F-stat.	4.6996
I(0) at 5%	2.39
I(1) at 5%	3.38
Results	Long-run Co-integration

Thus, from Table 5, the null hypothesis of no-level relationship is rejected, providing robust evidence for a stable long-run cointegrating relationship and validating the existence of an equilibrium connection between inflation and macroeconomic determinants in Nepal.

The result presented in Table 6 presents the long-run equilibrium and final co-integration test from the ARDL approach. The estimated long-run coefficients show that LN_EXC and LN_GDP are statistically significant determinants of inflation at the 5% level, with an exchange rate exhibiting a negative relationship and GDP showing a positive association. However, the LN_NEP, TR, and D variables do not show a significant long-run impact on inflation.

Table 6: Long-run and Short-run coefficients using ARDL

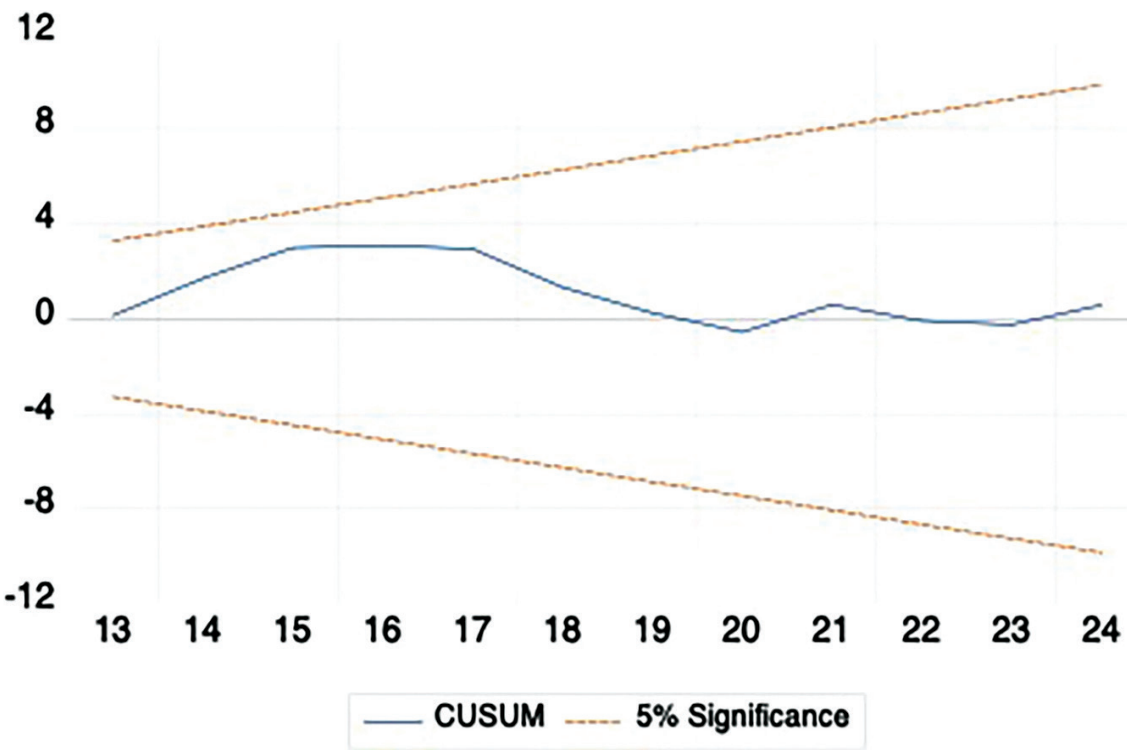
Variable	Coefficient	Std. Error	t-stat.	p-value	Interpretation	Model
LN_EXC	-28.60283	8.356685	-3.422748	0.0027	A 1% depreciation leads to 28.6% increase in long-run inflation.	Long-Run
LN_GDP	22.62747	8.009863	2.824951	0.0105	A 1% growth leads to 22.6% increase in long-run inflation.	Long-Run
LN_NEP	-1.260608	1.816886	-0.693829	0.4958	No statistically significant long-run relationship with inflation.	Long-Run
TR	5.455500	6.110217	0.892849	0.3826	No statistically significant long-run relationship with inflation.	Long-Run
D	-0.901541	2.837699	-0.317701	0.7540	The long-run effect of structural break D is not statistically significant long-run relationship with inflation.	Long-Run
C	-22.89539	35.82631	-0.639066	0.5300	The model's constant term is not statistically insignificant.	Long-Run
D(LN_EXC)	11.74582	5.141696	2.284425	0.0334	A 1% depreciation leads to an 11.74% increase in current inflation.	Short-Run
D(LN_GDP)	-20.51297	6.575572	-3.119572	0.0054	A 1% growth leads to a 20.5% decrease in current inflation	Short-Run
D(D)	-4.297958	1.621335	-2.650875	0.0153	The break event caused an immediate 4.3%-point drop in inflation	Short-Run
CointEq (-1)*	-0.645690	0.098735	-6.539619	0.0000	64.56% of a short-run inflation shock is corrected annually	Short-Run

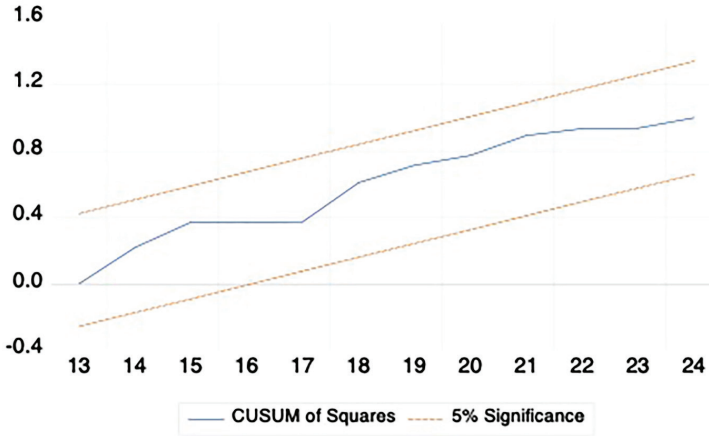
The Error Correction Estimation derived from the ARDL model in Table 6 confirms a significant and rapid adjustment process towards long-run equilibrium, with the Error Correction Term (CointEq (-1)) of -0.6456 being significant at both 1% and 5% levels, indicating that 64.56% of any short-run inflationary disequilibrium is corrected within one year. The model identifies significant short-run drivers of inflation: the changes in D(LN_EXC) and D(LN_GDP) are both significant at the 5% significance level, validating their immediate impact. These estimates have clear policy meaning. The large and significant long-run effect of the exchange rate implies that even moderate depreciation can translate into noticeable inflation over time, so exchange-rate management and reserve policy need to be closely aligned with the inflation objective. Likewise, the positive long-run effect of real GDP suggests that when activity is strong and capacity is right, monetary and fiscal policy should avoid additional demand pressure, through rapid money growth or large deficits, if price stability is a priority.

Based on Figure 3, both CUSUM and CUSUM of Square test remain within the red dashed critical boundaries at the 5% significance level throughout the entire sample period. This study includes a structural dummy for year 2011 to capture the NEPSE crisis and the index fell to an all-time low on June 15, 2011 shows a significant positive effect on inflation ($\beta = 29.39$, $p < 0.05$), with amid speculative, NRB liquidity tightening which make market sharp correction along with financial sector distress confirming crisis introduced a permanent shift in Nepal's inflationary process. Consistent with this break, the dummy is significant in this model, while lagged NEPSE-dummy interactions are not. This result highlights an immediate shift in the inflation process rather than a persistent change in the lagged stock-price transmission (Baral & Katuwal, 2024; Shrestha & Subedi, 2014).

By contrast, interaction with other variables (GDP, Turnover Ratio, and Exchange Rate) was not statistically significant, indicating that these macroeconomic variables remained relatively stable despite the structural break.

Figure 3: CUSUM Test and CUSUM of Square Test





The results of each figure indicate the model's robustness, highlighting a reliable foundation for the model specification. The stability in variance reinforces the reliability of the model's standard errors and statistical inferences.

Based on the diagnostic tests provided in Table 7, the estimated ARDL model is robust and satisfies the key econometric assumptions. The Breusch-Godfrey Serial Correlation test ($\chi^2 = 0.6259$, p=0.7313) and Breusch-Pagan Godfrey Heteroskedasticity ($\chi^2 = 10.2420$, p=0.3312) both fail to reject the null hypothesis at 5% significance level.

Table 7: Serial Correlation LM test and Breusch-Pagan-Godfrey Test

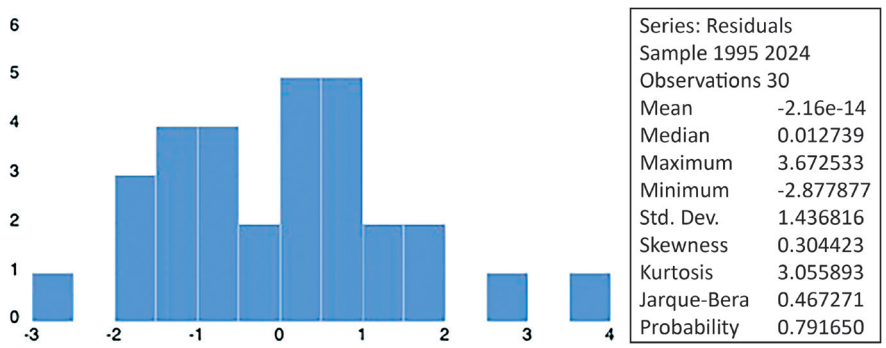
Test	Null Hypothesis	Test Statistics	p-value	Inference
Breusch-Godfrey Serial Correlation	No serial correlation	$\chi^2 = 0.6259$	0.7313	Fail to reject H0
Breusch-Pagan Godfrey Heteroskedasticity	Homoskedasticity	$\chi^2 = 10.2420$	0.3312	Fail to reject H0

Note: H0 denotes the null hypothesis.

Thus, Table 7 confirms that the model exhibits no serial correlation and Homoskedasticity, validating the reliability of the coefficient estimates and inference procedures (Rutledge & Barros, 2002; Akpan & Moffat, 2018).

The residuals of the estimated model demonstrate strong adherence to the assumption of normality in Figure 4. This is conclusively supported by a Jarque-Bera test statistic with a high p-value of 0.791, rejecting the null hypothesis of a normal distribution.

Figure 4: Histogram Normality Test



The near-zero skewness of 0.304 confirms the symmetry of the residual distribution, whereas the kurtosis of 3.056 is identical to that of a perfect normal distribution. The standard errors, confidence intervals, and p-values derived from Figure 4 are reliable, underpinning the validity of all subsequent hypothesis tests and conclusions drawn from the analysis (Bera & Jarque, 1981).

In Table 8, Granger Causality testing was employed to examine the directional predictive relationships among macroeconomic and financial variables, which is crucial in a small open economy like Nepal (Granger, 1969).

Table 8: Granger Causality Tests

Null Hypothesis (H_0)	F-Statistic	p-value	Result (5%)	Short Interpretation
LN_EXC does not Granger-cause Dummy	4.1922	0.0274	Rejected	Exchange rate shocks significantly precede structural breaks, highlighting Nepal's vulnerability to external factors.
LN_NEPSE does not Granger-cause LN_GDP	6.2898	0.0064	Rejected	Stock market movements lead GDP, confirming the financial–real sector transmission channel.
LN_NEPSE does not Granger-cause Dummy	3.4633	0.0477	Rejected	NEPSE strongly influences the structural break, reinforcing the 2011 crisis as market-driven.
CPI does not Granger-cause LN_GDP	1.4832	0.2470	Not rejected	Inflation does not significantly impact GDP in the short term.
Dummy does not Granger-cause CPI	0.5881	0.5632	Not rejected	The structural dummy itself does not Granger-cause changes in CPI.
LN_EXC does not Granger Cause CPI	1.0700	0.3588	Not rejected	Exchange rate shocks do not directly Granger-cause CPI.

Therefore, from the aforementioned interaction term and Granger causality in Table 8, it is evident that the 2011 structural break was predominantly a financial-market-driven event, characterized by stock market shocks and exchange rate volatility. The Granger causality tests support a directional interpretation of these relationships. Stock market movements are found to Granger-cause GDP, indicating that financial conditions tend to move ahead of real activity, while exchange-rate changes precede the identified structural break. At the same time, inflation does not Granger-cause GDP, which is consistent with the view that in Nepal inflation is mainly driven by external and real-side shocks rather than by feedback from output in the short run.

Diagnostic and stability tests indicate that the results are robust. The absence of serial correlation and heteroscedasticity, the normal distribution of residuals, and the stability of the CUSUM and CUSUM of squares statistics collectively suggest that the ARDL model is well-specified and that the estimated coefficients and error-correction term are reliable over the sample period. This strengthens confidence in the long-run relationship and in the policy, conclusions drawn from it.

5. Discussion and Implication

The results provide strong evidence that varied theoretical channels influence Nepal's inflation. First, the persistence of monetary effects supports the Quantity Theory of Money, where rapid growth of broad money relative to real GDP fuels inflation (Friedman, 1968; Shrestha & Timilsina, 2025). Even though the Nepal Rastra Bank targets monetary aggregates rather than prices directly, the ARDL results confirm that liquidity growth is inflationary in the long run, consistent with monetarist views that "inflation is always and everywhere a monetary phenomenon"(Friedman, 1977). Second, the significance of GDP growth as a long-run driver aligns with Keynesian demand-pull theory, which stresses that excess aggregate demand

relative to productive capacity triggers price pressures (Keynes, 1937; Blinder & Solow, 1973). The positive long-run GDP-inflation relationship aligns with regional evidence that integrates fiscal deficits and growth, leading to inflationary results (Nguyen, 2015; Srivastava et al., 2024). However, the negative short-run coefficient indicates that output growth temporarily reduces demand-side pressures.

Cost inflation from oil and agricultural shocks has contributed to Nepal's inflation, mainly caused by structural factors such as large import dependence and weak infrastructure (Zakaria et al., 2021; Shrestha & Timilsina, 2025). The structuralist theory that inflation in developing economies arises from bottlenecks and institutional rigidities, rather than asset-price bubbles, is also reinforced by the insignificance of stock market variables (Olivera, 1964; Canavese, 1982). This is also supported by the 2011 NEPSE crisis, which had only a temporary effect, suggesting that the major cause is structural rather than financial (Kim, 2023; Baral & Katuwal, 2024). Finally, the delayed impact of exchange rate changes aligns with the open-economy exchange rate pass-through framework. Altogether, these outcomes enhance the study by highlighting that all four theoretical components concurrently influence Nepal's inflation dynamics, while also emphasising the essential significance of structural breaks for precise empirical modelling. Thus, the findings collaborate with previous studies (Ginting, 2007; Nepal & Nepal, 2010; Nasir et al., 2020; Lama et al., 2025), demonstrating that depreciation gradually influences consumer prices over time, underscoring Nepal's susceptibility to imported inflation due to its currency peg with the Indian rupee and significant dependence on imports.

According to this study, the combined effects of monetary, demand-driven, structural, and external factors are responsible for Nepal's inflation. The ARDL results indicate that monetary growth and fiscal disequilibrium are the foundation of sustaining price pressures, addressing both monetarist and Keynesian theories. At the same time, structural drawbacks, including significant dependence on imports, agricultural vulnerabilities, and infrastructural shortfalls, persist to support inflation, strengthening the Structuralist approach. The credible evidence of exchange-rate pass-through highlights Nepal's external vulnerability within its fixed exchange-rate system. This study strengthens current works by integrating structural breaks, demonstrating that financial crises such as the 2011 NEPSE crisis might temporarily influence processes but do not negate the long-run influence of these macroeconomic factors.

The findings for policymakers are multidimensional. To raise the credibility of monetary policy, it is crucial to transform to an inflation-targeting approach that explicitly measures exchange rate vulnerabilities, rather than relying exclusively on the aggregate money supply (Suzuki, 2019; Adhikari et al., 2024). Secondly, fiscal discipline is essential, as demand-pull factors exacerbated by deficits intensify inflationary risks (Paudel, 2005; Aragaw, 2024). Third, structural reforms that enhance agricultural output, diversify energy sources, and reduce import dependence are crucial in mitigating cost-push inflation resulting from supply constraints. Although the financial sector currently has a low impact on inflation, the deepening of capital markets may enhance monetary transmission and expand stabilization instruments in the long run. Subsequent studies should investigate high-frequency data, non-linear ARDL methodologies, and cross-country comparisons to evaluate the robustness of these mechanisms in other South Asian small open economies.

6. Conclusion, Limitations, and Future Research

This paper examined the drivers of inflation in Nepal using an ARDL (1,1,1,0,0,0) model with an explicit structural break around the 2011 NEPSE crisis. The results show a clear long-run cointegrating relationship between inflation, the exchange rate depreciation tends to raise inflation, and higher output temporarily eases price pressure. The error correction term indicates that approximately two-thirds of any deviation from the long-run equilibrium is corrected within one year, suggesting that inflation in Nepal adjusts relatively quickly back to its underlying path.

This study also has limitations, which point to useful directions for future work. The analysis relies on annual data from a relatively small sample, which restricts the number of variables and lags that can be

included and prevents a close examination of work's very short-run dynamics. Important determinants, such as explicit fiscal indicators, money growth, food and oil prices, or measures of expectations, could not be incorporated simultaneously without losing degrees of freedom. The structural break is treated in a straightforward manner, using a single dummy variable for the 2011 NEPSE episode. The other changes in policy regimes or global shocks are captured only indirectly. Future researchers could address these limitations by using higher-frequency data, allowing for multiple breaks and nonlinearities, through non-linear ARDL or time-varying parameters models, and by extending the framework to a panel of South Asian economies to compare how inflation transmission differs across small open economies with similar structural constraints.

Overall, the findings suggest that controlling inflation in Nepal necessitates a balanced approach. Monetary and fiscal discipline remain necessary, but they must be complemented by structural reforms that ease supply-side bottlenecks and by a competitive policy framework that recognizes the central role of external shocks, along with the exchange rate. Without progress on these fronts, inflation is likely to remain vulnerable to global disturbances and domestic rigidities, even if short-run fluctuations can be adjusted.

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