LEX LOCALIS-JOURNAL OF LOCAL SELF-GOVERNMENT
ISSN:1581-5374 E-ISSN:1855-363X
VOL. 24, NO. 1(2026)

An Attempt to Estimate the Effects of Interest Rates on Inflation Using the Asymmetry Theory

SLIMANI Abdelwahab

slimaniabdelwahab01@univ-adrar.edu.dz
Ahmed Draia University of Adrar

Received: 20/02/2026 Accepted: 23/05/2026 Published: 18/06/2026

Introduction

Interest rates are among the most important variables used by monetary authorities to curb inflation (control price levels). The complex interaction between interest rates and inflation constitutes a central theme in economic research and policymaking. Understanding the dynamic relationship between these two key variables is crucial for designing effective monetary policies and steering economies toward stability.

As a monetary policy instrument, interest rates play a pivotal role in influencing inflationary pressures. This relationship is multifaceted and involves complex dynamics that vary across economic contexts and time horizons. Examining the intricate links between interest rates and inflation provides valuable insights into the mechanisms driving economic fluctuations and helps policymakers maintain price stability and achieve sustainable economic growth.

Inflation is considered one of the major economic problems threatening all countries, regardless of their level of economic development or the nature of their economic systems. Due to its adverse effects, inflation undermines opportunities for economic stability and creates an unfavorable environment for successful development. Monetary policy, more than other macroeconomic policies, is responsible for addressing inflationary pressures, strengthening the value of the domestic currency, and ensuring price stability to promote economic growth and development objectives.

Research Problem

This study attempts to answer the following main question:

Do inflation rates in Algeria respond symmetrically or asymmetrically to changes in interest rates?

Hypotheses

- The impact of interest rates on inflation in Algeria is asymmetric.
- Negative changes in interest rates have a greater impact on inflation than positive changes; that is, there exists asymmetric causality between positive and negative interest-rate shocks.

Significance and Objectives

The importance of this study lies in its scientific contribution at both the academic and practical levels. It enriches the growing literature on nonlinear investigations of monetary policy instruments by demonstrating how dynamic economic conditions affect monetary policy.

Specifically, the study examines the asymmetric relationship between interest rates and inflation and investigates how inflation reacts to positive and negative changes in interest rates using the **Nonlinear Autoregressive Distributed Lag (NARDL)** model. It also assesses the model's ability to explain the economic relationship between the variables and determine whether inflation reacts differently when interest rates decline compared with when they rise. Furthermore, the study explores the causal relationship among the variables and identifies its direction.

Review of Previous Studies

I. Foday & Ousman (2020)

This study examined the effects of interest rates and inflation on exchange rates in Gambia using the Fully Modified Ordinary Least Squares (FMOLS), Dynamic Ordinary Least Squares (DOLS), and Canonical Cointegrating Regression (CCR) models for the period 2007–2018.

The long-run results indicated a positive relationship between inflation and exchange rates, implying that higher inflation increases exchange rates. In contrast, interest rates were negatively associated with exchange rates, meaning that an increase in interest rates leads to a depreciation of the Gambian Dalasi (GMD). Granger causality analysis revealed the existence of a unidirectional causal relationship.

II. Selvanayagam & Mustafa (2019)

The authors investigated the impact of unemployment and interest rates on inflation in Sri Lanka. They also discussed the Phillips relationship between inflation and unemployment using annual data from 1953 to 2015. Variables included inflation, unemployment, interest rates, money supply (M2), and government expenditure.

Using the ARDL cointegration approach, the study found that unemployment has a statistically significant negative effect on inflation in both the short and long run. Furthermore, the Phillips curve relationship exists in the Sri Lankan economy. Interest rates negatively affect inflation in the short run but positively influence inflation in the long run.

III. Hüseyin & Barış (2019)

The study analyzed the relationship between stock prices and macroeconomic variables, noting that most existing literature assumes a linear relationship. Using the NARDL model, the authors examined the asymmetric effects of output, interest rates, and exchange rates on Turkish stock prices.

The results revealed both long-run and short-run asymmetric relationships between macroeconomic variables and stock prices. The findings suggested that nonlinear models provide more realistic results than linear models when analyzing macroeconomic variables.

IV. Nicholas & Arusha (2015)

The authors investigated asymmetric interest rates using the NARDL model based on data from the United States, the United Kingdom, and Australia during the period 2000–2013.

Their results showed an asymmetric effect between commercial bank interest rates and central bank discount rates, supporting the asymmetric market hypothesis. Robustness tests conducted before and after the financial crisis confirmed that asymmetry remained significant only in the case of Australia.

V. Markus & Michael: *When Low Interest Rates Cause Low Inflation*

The authors analyzed the Neo-Fisherian theory, which predicts low inflation as a consequence of low central bank interest rates. They argued that low inflation is not caused by the low policy rate itself but by a low equilibrium real interest rate, representing the real interest rate consistent with full employment and stable prices.

Combined with the zero lower bound on nominal interest rates, this reduces the effectiveness of monetary policy and leads to lower inflation. Therefore, stabilizing inflation in the medium term requires raising the equilibrium real interest rate. Since monetary policy cannot directly influence this equilibrium rate, structural policies are necessary.

VI. Moussaoui and Jaballah (2019)

The researchers examined the asymmetric relationship between interest rates and inflation in Algeria during the period 1980–2017 using the NARDL model to measure the effects of positive and negative interest-rate changes on inflation.

Their findings revealed the existence of a cointegration relationship and confirmed that the relationship between the two variables is nonlinear.

What distinguishes this study is the use of the relatively recent NARDL methodology, employing macroeconomic variables of significant economic importance to investigate the reciprocal relationship between inflation and interest rates. Unlike previous studies, it focuses on a different study period within the Algerian context and further examines interest-rate behavior through the Hatemi-J (2012) asymmetric causality test.

1. Interest Rate and Inflation Dynamics

The interaction between interest rates and inflation constitutes a crucial aspect of monetary policy and economic dynamics. Interest rates set by central banks influence borrowing costs and the overall cost of capital in the economy. When interest rates are high, borrowing becomes more expensive, leading to lower spending and investment. This, in turn, may reduce demand for goods and services, exerting downward pressure on prices.

Conversely, low interest rates can stimulate borrowing, spending, and investment, thereby promoting economic growth. However, if these conditions persist, they may also contribute to higher inflation, as increased demand exceeds the economy's capacity to supply goods and services.

In summary, the relationship between interest rates and inflation is complex. Central banks carefully manage interest rates to strike a balance between stimulating economic activity and preventing excessive inflation, with the ultimate goal of achieving price stability and sustainable economic growth.

Interest rates affect inflation through several mechanisms. The main channels are as follows:

A. Borrowing Costs

When central banks raise interest rates, borrowing becomes more expensive. Higher interest rates increase financing costs for businesses and consumers, thereby reducing borrowing and spending. This reduction in expenditure may decrease demand for goods and services, placing downward pressure on prices.

B. Investment

Higher interest rates may discourage investment by increasing the cost of financing business projects. Reduced investment can lower economic activity and slow growth, affecting aggregate demand and potentially moderating inflation.

C. Consumer Spending

Higher interest rates often increase the cost of consumer loans, such as mortgages and car loans. As a result, consumer spending declines, reducing demand for goods and services and affecting the overall price level.

D. Exchange Rate Effects

Changes in interest rates can influence the value of a country's currency. Higher interest rates attract foreign capital seeking greater returns, leading to currency appreciation. A stronger currency can reduce import prices, thereby contributing to lower inflation.

E. Expectations

Expectations regarding future interest rates play a crucial role. If businesses and consumers anticipate rising interest rates, they may adjust their spending and investment decisions accordingly. Such expectations can influence inflationary pressures.

F. Cost-Push Inflation

Higher interest rates can contribute to cost-push inflation by increasing financing costs for firms. Rising production costs may then be passed on to consumers in the form of higher prices for goods and services.

G. Real Interest Rates

Real interest rates, which account for inflation, influence borrowing and investment decisions. Central banks may adjust nominal interest rates to maintain positive real interest rates, thereby affecting economic activity and inflation dynamics.

It is important to note that the relationship between interest rates and inflation is highly complex. The effectiveness of interest rate policies depends on economic conditions, expectations, and other factors. Central banks take these factors into account when formulating monetary policy in pursuit of their dual objective of price stability and sustainable economic growth.

2. Empirical Framework of the Study

This section presents the econometric modeling of the asymmetric effects of interest rates on inflation in Algeria over the period 1980–2019, using the Nonlinear Autoregressive Distributed Lag (NARDL) model.

Initially, the model specification and the study variables are introduced. Subsequently, stationarity tests are conducted, followed by the Bounds Test for cointegration. Thereafter, the empirical results are presented and analyzed from both statistical and economic perspectives.

It should also be noted that the model estimation was carried out using EViews 12 software.

2.1 Specification of the Study Model

In order to investigate the asymmetric effects of interest rates on inflation in Algeria, the study model and variables were specified as follows:

$$LINF_t = \beta_0 + \beta_1 LINR_t + \beta_2 LM2 + e_t \ldots (1)$$

The model used to capture the asymmetric effects of interest rates on inflation is formulated as follows:

Where:

- (LINF_t) represents inflation in logarithmic form;
- (LINR_t^+) represents positive changes in interest rates in logarithmic form;
- (LINR_t^-) represents negative changes in interest rates in logarithmic form;
- (LM2_t) represents the money supply (M2) in logarithmic form. It is used as a control variable to assist in explaining the dependent variable and to isolate its influence from the main explanatory variables of the study.

2.2 Data and Methodology

The sample was selected in accordance with the objective of the study, namely, to examine the asymmetric effects of interest rates on inflation in Algeria, subject to the availability of data for the variables under investigation over the period 1980–2019, yielding a total of 40 observations.

Annual data for the three variables were collected from the Bank of Algeria, the National Office of Statistics (ONS), and the World Bank.

2.3 Descriptive Statistics of the Variables

To perform the descriptive analysis of the variables and conduct statistical tests on the time series under study, measures such as the mean, median, and mode were computed. Normality tests were also conducted using skewness, kurtosis, and the Jarque-Bera statistic, as presented in Table 1.

Table 1. Descriptive Statistics of the Variables

	LINF	LINR	LM2
Mean	8.864	7.971	14.612
Median	5.735	8.000	14.278
Maximum	31.670	19.000	54.051
Minimum	0.339	3.000	−0.850
Std.Dev.	8.235	3.696	9.417
Skewness	−0.045416	2.575020	1.426903
Kurtosis	8.608305	3.571673	2.481836
Jarque-bara	19.523	14.219	80.893
Probability	0.128560	0.990031	0.064000
Observations	40	40	40

It can be observed that the sample consists of 40 observations. The standard deviation of LINR reached 3.696%, followed by LINF with a standard deviation of 8.235%, indicating relatively high variability. Nevertheless, the data exhibited limited dispersion around their arithmetic means.

The kurtosis and skewness coefficients ranged between 2.48 and 8.60, and 0.04 and 2.56, respectively, indicating deviations from zero. Furthermore, according to the Jarque-Bera statistics, the variables generally follow a normal distribution, with the exception of LM2. Therefore, the statistical indicators are considered acceptable.

2.4 Stationarity Analysis of the Study Variables

Before estimating the NARDL model, it is necessary to ensure that none of the time series is integrated of order two or higher. The presence of variables integrated of order I(2) or above would render the results invalid. Therefore, applying unit root tests is essential.

2.4.1 Unit Root Tests of Time Series

Prior to estimating, diagnosing, and evaluating the model, it is necessary to verify the stationarity of the time series constituting the econometric model to avoid what is known as **spurious regression**. To determine the order of integration of the series, two commonly used unit root tests were employed:

- the **Augmented Dickey-Fuller (ADF)** test, and
- the **Phillips-Perron (PP)** test.

The results are summarized in Table 2.

Table 2. Unit Root Test Results Using ADF and PP Tests

Time Series	Model	Level ADF	Level PP	First Difference ADF	First Difference PP	Order of Integration
LINF	**C**	**-**	**-**	*****-5.66**	*****-5.66**	
	C + Trend	**-**	**-**	*****-5.58**	*****-5.57**	**I(1)**
LINR	**C**	**-5.06*****	****-3.24**			
	C + Trend	**-**	**-**	*****-5.14**	****-3.66**	**I(1)**
LM2	**C**	*****-4.77**	*****-4.77**	**-**	**-**	
	C + Trend	*****-5.06**	*****-5.06**	**-**	**-**	**I(0)**

The results indicate that the M2 series is stationary at level. This conclusion is obtained by comparing the calculated t-statistic with the critical values at the corresponding significance levels. Accordingly, the null hypothesis is rejected, implying that the series is integrated of order I(0).

In contrast, the variables LINF and LINR are not stationary at level but become stationary after first differencing, indicating that they are integrated of order I(1) according to both the ADF and PP tests.

Therefore, none of the variables is integrated of order two, satisfying a fundamental requirement for estimating the NARDL model.

2.4.2 Stationarity Test with Structural Break

In addition to the ADF and Phillips-Perron (PP) tests, several unit root tests account for structural changes. One such test is the Zivot-Andrews (1992) test.

The estimation procedure of this test identifies break points corresponding to the minimum value of the t-statistic and compares them with the tabulated critical values. Acceptance or rejection of the null hypothesis depends on this comparison.

Table 3. Results of the Zivot-Andrews Unit Root Test with Structural Break

Variables	ZA Statistic	Critical Value (1%)	Critical Value (5%)	Critical Value (10%)	Probability (Prob.)	Structural Break Year
LINF	-4.48	-5.57	-5.08	-4.82	0.0005	1997

LINR	-5.06	-5.57	-5.08	-4.82	0.03	1994
LM2	-5.58	-5.57	-5.08	-4.82	0.17	2013

The results of the Zivot-Andrews structural break test reveal that the probability values associated with the ZA statistic are greater than the critical values at all significance levels. Consequently, the null hypothesis cannot be rejected, indicating the existence of a unit root with a structural break in the series under consideration.

Interpretation of the Structural Break Unit Root Test Results

For the variables LINF and LINR, the null hypothesis of the existence of a unit root with a structural break is accepted. In contrast, for the LM2 series, the alternative hypothesis of no unit root with a structural break in 2013 is accepted. These results support the findings obtained from the conventional unit root tests, namely the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests. The presence of structural breaks during the study period indicates that the behavior of these variables changes over time.

Overall, the results are consistent in showing that the variables are stationary either at level or after first differencing, without exceeding the first order of integration. Moreover, the findings confirm that all series experienced structural breaks at different points in time.

2.4.3 Nonlinear Unit Root Test: BDS Test for Nonlinearity

The BDS test (Brock, Dechert, and Scheinkman) is employed to determine whether time-series data exhibit nonlinear characteristics. The test examines the null hypothesis that the data are independently and identically distributed (i.i.d.). Rejection of the null hypothesis indicates the presence of nonlinear behavior in the data.

Thus, the BDS test is used to verify whether the variables under study are symmetrically and independently distributed. The results are presented in Table 4.

Table 4. BDS Nonlinearity Test Results

Variables	m = 2	m = 3	m = 4	m = 5	m = 6
LINF	*0.113	*0.213	*0.432	*0.540	*0.967
LINR	**0.067	**0.091	*0.123	*0.182	*0.236
LM2	***0.026	***0.030	**0.069	**0.083	**0.990

Source: Outputs from R software.

Significance levels:
*** = 1%; ** = 5%; * = 10%.

The results indicate that the calculated BDS statistics exceed the critical values at the 1%, 5%, and 10% significance levels. Consequently, the null hypothesis is rejected in favor of the alternative hypothesis, which suggests the existence of nonlinear behavior in the study variables under different embedding dimensions (m = 2, ..., 6).

These findings imply that the combination of different integration orders, the existence of several structural breaks, and the nonlinear characteristics of the variables provide early evidence of asymmetric behavior in the time series over time. Therefore, the existence of asymmetric relationships is likely, making the NARDL approach and cointegration testing particularly appropriate.

2.5 Bounds Test

To verify the existence of a cointegration relationship within the VECM framework, Pesaran et al. (2001) proposed the Bounds Test, while Narayan extended the critical values for small samples. The test relies on the Wald test and the corresponding F-statistic.

The results of the cointegration test and the critical values at various significance levels are reported below. The critical values proposed by Narayan are employed because they are more appropriate for relatively small samples ranging from 30 to 80 observations, whereas the critical values provided by Pesaran (2001) may be less accurate under such conditions.

Table 5. Bounds Test Results

Significance Level	Pesaran (2001)	Narayan (2005)
	Lower Bound I(0)	Upper Bound I(1)	Lower Bound I(0)	Upper Bound I(1)
1%	3.65	4.66	3.908	5.044
5%	2.79	3.67	2.920	3.838
10%	2.37	3.20	2.474	3.312

As shown in Table 5, the calculated F-statistic of the Bounds Test is 14.75, which exceeds the critical values at all conventional significance levels. Therefore, the null hypothesis of no long-run equilibrium relationship is rejected, and the alternative hypothesis is accepted, confirming the existence of cointegration among the variables.

2.6 Estimation of the NARDL Model

After confirming the existence of a cointegration relationship between interest rates and inflation, the long-run relationship is estimated within the framework of the **Nonlinear Autoregressive Distributed Lag (NARDL)** model. This stage involves obtaining parameter estimates for both the long-run and short-run dynamics.

2.6.1 Long-Run Parameters

The estimation results are presented in Table 6.

Table 6. Long-Run Estimation Results

Prob	إحصائية t	المعلمات	المتغيرات
0.0045	3.093287	0.635186	$LINR^{+}t$
0.000	6.887518	2.186035	$LINR^{-}t$
0.7367	0.339599	0.027613	$LM2_t$

Based on the previous table, the long-run equation can be expressed as follows:

$$LINF t = 0.635186 LINR{+}t + 2.186035\ LINR{-}t + 0.027613 LM2t$$

Long-Run Equation Interpretation

The estimated equation reflects the expected behavior of the variables, with coefficient signs consistent with economic theory. Specifically, the positive coefficient associated with positive changes in interest rates indicates that this variable has a direct effect on inflation in the long run. A 1% increase in interest rates leads to an increase in inflation by approximately **0.63%**. Likewise, a 1% decrease in interest rates results in an increase in inflation by about **2.18%**, as indicated by the positive sign of the corresponding coefficient.

2.6.2 Short-Run Dynamics and the Error Correction Term

The results are reported in Table 7.

Table 7. Short-Run Estimation Results and Error Correction Term

Variables	**Coefficient**	**t-Statistic**	**Probability (Prob.)**
$\Delta LINR^{+}t$	0.582945	2.760317	0.0101
$\Delta LINR^{+}t{-}1$	-4.388270	-2.586307	0.0152
$\Delta LINR^{+}t{-}2$	9.435102	6.436315	0.0000
LM2	0.025342	0.343739	0.7336
CointEq(-1)	-0.917755	-8.083545	0.0000

From Table 7, it can be observed that inflation in the short run is influenced by its own lagged values as well as by positive and negative fluctuations in interest rates. The effect of positive changes in interest rates is positive and statistically significant, whereas the effect of negative changes is negative and statistically significant at the first lag, implying the existence of asymmetric effects on inflation.

Regarding the error correction coefficient, **CointEq(-1)**, which captures the speed of adjustment from the short run toward the long-run equilibrium, it is required to be negative and statistically significant in order to confirm the existence of a long-run relationship among the variables. The estimated coefficient equals **–0.917755**, which is negative and significant at the 1% level. This implies that approximately **91.8%** of short-run disequilibria are corrected in each period, allowing the system to converge toward its long-run equilibrium.

2.6.3 Asymmetry Test

One distinctive feature of the **NARDL model** is its ability to test whether the relationship between variables is symmetric or asymmetric. This is accomplished through the **Wald test**, which examines whether positive and negative changes have identical effects. Using **EViews 10**, the following hypotheses were tested (Imad Eddine, 2018, p. 6):

H0:C(3)C(2)=C(4)C(2)H_0 :
\frac{C(3)}{C(2)}=\frac{C(4)}{C(2)}H0 :C(2)C(3) =C(2)C(4)

There is no asymmetry in the relationship.

H1:C(3)C(2)≠C(4)C(2)H_1 :
\frac{C(3)}{C(2)}\neq\frac{C(4)}{C(2)}H1 :C(2)C(3) =C(2)C(4)

There is asymmetry in the relationship.

Table 8. Results of the Asymmetry Test

Test Statistic	**F-Statistic**	**Probability (Prob.)**	**Decision**
Wald Test	6.837	0.0142	Presence of asymmetry

As shown in Table 8, the calculated probability value of the **F-statistic** is lower than the 5% significance level. Consequently, the null hypothesis is rejected in favor of the alternative hypothesis, indicating the existence of an **asymmetric relationship**. Thus, positive and negative changes in interest rates exert asymmetric effects on inflation.

These findings support the previous results, which showed that positive changes in interest rates are positively related to inflation, whereas negative changes in interest rates are negatively related to inflation.

2.7 Diagnostic Tests for the NARDL Model

To ensure the reliability of the estimated model, a number of diagnostic tests are conducted to verify the absence of econometric problems such as serial correlation, heteroskedasticity, and departures from normality. Once the adequacy of the model and the accuracy of its results are confirmed, the stability of the model can be assessed.

2.7.1 Diagnostic Tests

Table 9. Diagnostic Test Results

Diagnostic Aspect	Test Type	Statistic (p-value)	Conclusion
Functional Form Specification	**RESET (F) Test**	**0.655606 (0.4252)**	**Correct functional form**
Heteroskedasticity	**Breusch Test**	**0.314513 (0.9175)**	**Homoskedastic residuals**
Normality of Residuals	**Jarque-Bera Normality Test**	**0.9379 (0.6250)**	**Residuals are normally distributed**
Serial Correlation	**LM(F) Test**	**0.917614 (0.2767)**	**No serial correlation**
Model Stability	**CUSUM Test**	**Stable**	**Stable model**
Model Stability	**CUSUMSQ Test**	**Stable**	**Stable model**

The results presented in Table 9 indicate the following:

- To detect the presence of serial correlation, the **Breusch-Godfrey LM test** was employed. Since the probability value satisfies

0.2767>0.05,0.2767 > 0.05,0.2767>0.05,

the null hypothesis is accepted, indicating the absence of serial correlation among the residuals.

- To assess heteroskedasticity, the probability value was found to be

0.9175>0.05,0.9175 > 0.05,0.9175>0.05,

which supports the null hypothesis of homoskedastic residuals, implying that the variance of the error terms remains constant.

- Regarding the **Jarque-Bera normality test**, the associated probability value equals **0.625**, which exceeds the 5% significance level. Therefore, the null hypothesis is accepted, confirming that the residuals follow a normal distribution.

Stability of the Estimated Model

Figures (1) and (2) demonstrate that the estimated model is stable. The **CUSUM** plot lies within the critical bounds, indicating parameter stability over the sample period. Similarly, the **CUSUM of Squares (CUSUMSQ)** plot remains within the upper and lower critical boundaries, suggesting that the model is stable at the 5% significance level.

Therefore, the **Nonlinear Autoregressive Distributed Lag (NARDL)** model is stable in both the short and long run.

Figure 1. CUSUM Stability Test

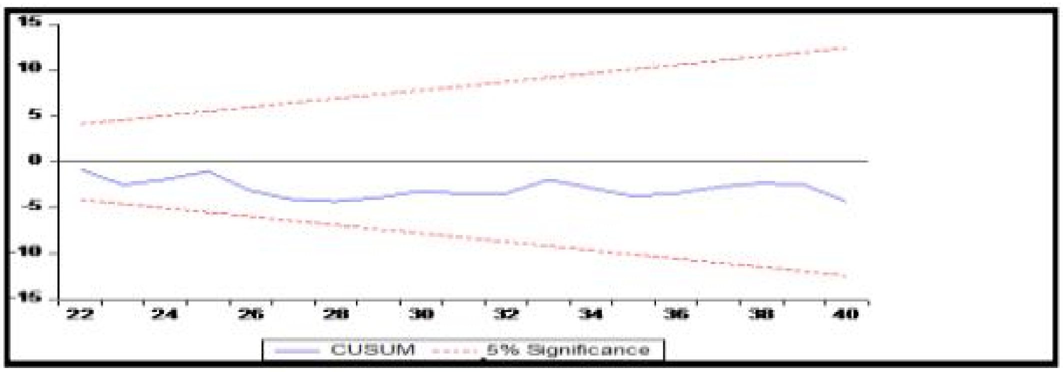
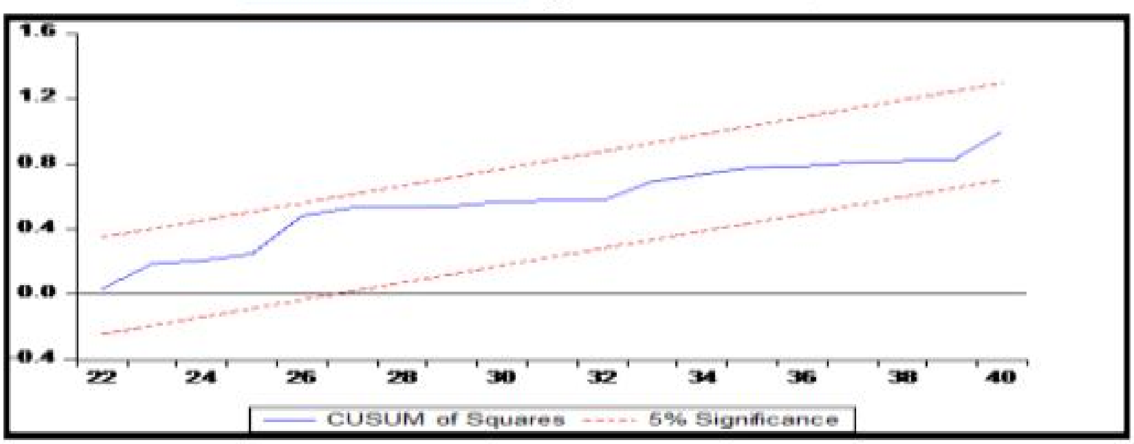


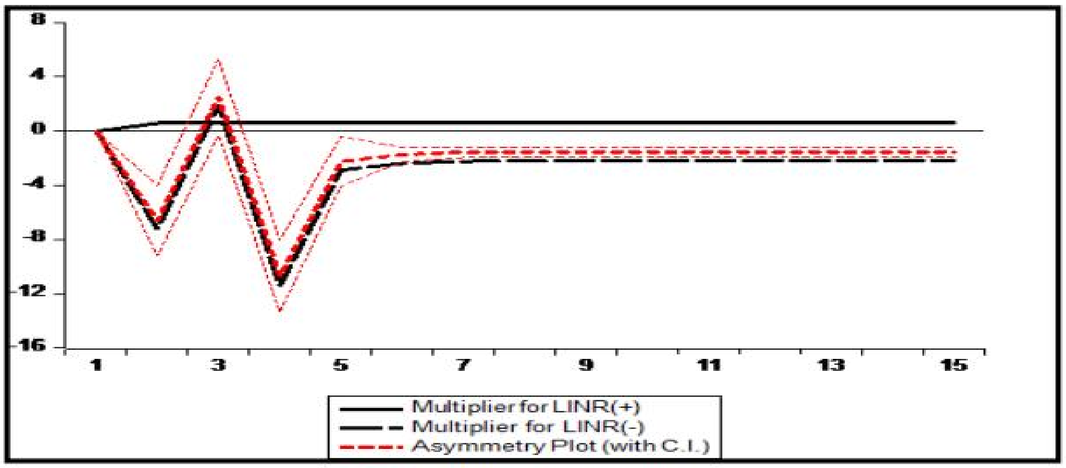
Figure 2. CUSUM of Squares Stability Test



2.7.2 Asymmetric Cumulative Dynamic Multiplier Test

The **Asymmetric Cumulative Dynamic Multiplier** test measures the effect of a one-unit change in positive and negative interest rate shocks on the inflation rate. It also analyzes adjustment paths and the duration of disequilibrium following positive or negative shocks. In this context, the horizontal axis represents the number of years required to attain long-run equilibrium, while the vertical axis measures the magnitude of positive and negative interest rate shocks, as illustrated in the following figure.

Figure 3. Asymmetric Cumulative Dynamic Multiplier



From the dynamic multiplier graph above, it can be observed that a positive shock to interest rates leads inflation to return to equilibrium after approximately one and a half years. Conversely, a negative shock results in inflation reaching equilibrium after about one year.

2.8 Asymmetric Causality Test

The Hatemi-J test is used to detect the presence of nonlinear cointegration between two variables and to determine whether their relationship is nonlinear. The test is based on the following hypotheses:

- Null hypothesis (H_0): There is no nonlinear relationship between the variables.
- Alternative hypothesis (H_1): There exists a nonlinear relationship between the variables.

The decision rule is based on whether the calculated test statistic exceeds the predetermined significance level. In such a case, the null hypothesis is rejected, indicating the presence of an asymmetric relationship. After conducting the asymmetric causality test to investigate the causal effects of positive and negative shocks on the variables under consideration, the results are summarized in Table 10.

Table 10. Results of the Hatemi-J Asymmetric Causality Test

Direction of Causality	Wald Statistic	Critical Value	Critical Value	Critical Value (10%)	Decision

(Positive/Negative Shocks)	(W Statistic)	(1%)	(5%)		
$INR^{+} \Rightarrow INF$	**5.686**	**14.245**	**9.123**	**12.342**	**No causality**
$INR^{-} \Rightarrow INF$	**8.456**	**10.345**	**32.984**	**11.098**	**No causality**
$INF^{-} \Rightarrow INR$	**0.976**	**3.087**	**5.124**	**1.654**	**No causality**
$INF^{+} \Rightarrow INR$	**4.663****	**2.768**	**3.967**	**7.126**	**Causality exists at the 5% level**

The final stage of the analysis consisted of testing the causal relationship between inflation and interest rates. The results provide evidence of a causal relationship running from positive inflation shocks to interest rates at the 5% significance level. For all other hypotheses, no causal direction was detected because the associated test statistics were not statistically significant.

These findings highlight the extent of the gaps and imbalances accompanying the use of monetary policy instruments in addressing inflationary problems within the national economy.

Conclusion

The objective of this study was to estimate the asymmetric effects of interest rates on inflation in Algeria over the period 1980–2019. To achieve this objective, the Nonlinear Autoregressive Distributed Lag (NARDL) model was employed after examining the characteristics of the data using several statistical tests.

The empirical results indicated that the variables exhibited mixed orders of integration, being stationary either at levels or first differences. Structural breaks were detected during the study period, and the BDS test confirmed the nonlinear behavior of the series. Furthermore, the bounds testing approach revealed the existence of a long-run equilibrium relationship between the study variables.

The results showed that positive changes in interest rates are positively related to inflation, whereas negative changes in interest rates are negatively associated with inflation in the short run. Moreover, interest rates exert asymmetric effects—both positive and negative—on inflation during the study period, as confirmed by the asymmetry test, thereby supporting the first research hypothesis.

The diagnostic tests also indicated satisfactory residual behavior and consistency between short-run and long-run dynamics. Consequently, the NARDL model proved to be the most appropriate framework for analyzing the relationship under investigation. Finally, the asymmetric causality analysis revealed the absence of significant causal relationships in most cases, leading to the rejection of the second hypothesis.

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