



Measuring and Explaining the Causes of Inflation Fluctuations in the Algerian Economy: An Empirical Study Using the ARDL Model (1990–2023)

Issam Louchene

University of batna 1

tarekxh07@yahoo.fr

Dalal Nouredine

Mohamed Khider University of Biskra

dalal.nouredine@univ-biskra.dz

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Abstract

This study aims to measure and explain the main determinants of inflation rate fluctuations in the Algerian economy over the period from 1990 to 2023. To achieve this objective, an empirical analytical approach was adopted using the Autoregressive Distributed Lag (ARDL) model to process the time series and examine the dynamic relationships between inflation (as the dependent variable) and a set of key macroeconomic indicators (broad money supply M_2 , public expenditure, official exchange rate of the Algerian dinar, and trade openness index), alongside dummy variables to control for structural shocks that affected the national economy over the past four decades.

The empirical results confirm the existence of a cointegrating relationship (long-run equilibrium) between inflation and its macroeconomic determinants. Growth in broad money supply and the exchange rate were identified as the most influential determinants of the Consumer Price Index (CPI) in the long run, confirming both the monetary and imported nature of inflationary pressures in Algeria. Furthermore, the Error Correction Term ($CointEq_{t-1} = -0.418$) showed a statistically significant negative coefficient, indicating an annual speed of adjustment of 41.8% towards long-run equilibrium following short-run shocks. The study concludes that controlling inflation in Algeria requires tight coordination between monetary and fiscal policies, alongside active economic diversification strategies to mitigate the pass-through of imported inflation via the exchange rate channel.

Keywords: Inflation; Price Fluctuations; Algerian Economy; ARDL Model; Money Supply; Exchange Rate; Imported Inflation; Cointegration

I. Introduction and Conceptual Framework

1.1 Background and Economic Context

Maintaining price level stability and mitigating inflationary pressures constitute the core objectives underpinning macroeconomic and monetary policy frameworks. This centrality stems from the direct role of inflation in eroding currency purchasing power, introducing friction into the investment climate, and distorting efficient resource allocation. The dynamics of inflation are exceptionally complex in developing, resource-dependent economies such as

Algeria, where internal structural supply-demand imbalances interact with external, imported shocks to produce pronounced price volatility.

Over the period spanning 1990 to 2023, the Algerian economy underwent structural transformations that profoundly shaped the behavior of the Consumer Price Index (CPI). Following the transition from a centrally planned to a market-oriented economy and the subsequent implementation of the Structural Adjustment Program (SAP) in the 1990s—which entailed price liberalization, foreign trade deregulation, and successive exchange rate devaluations—inflation rates escalated to unprecedented levels. Conversely, during the boom period (2000–2014) driven by elevated global crude oil prices, substantial fiscal expansion and liquidity injection through economic recovery programs induced demand-pull pressures. These pressures were partially buffered by state subsidies on basic food commodities and active exchange rate management.

However, the oil price shock of 2014 exposed the vulnerability of domestic price stability and highlighted the supply-side rigidity of the non-hydrocarbon sector. The subsequent reliance on non-conventional monetary financing (2017–2019) generated massive liquidity expansion without a corresponding increase in real domestic output. This structural fragility was further aggravated by global supply chain disruptions and currency depreciation during the COVID-19 pandemic and extending through the geopolitical shocks up to 2023. This accumulation of compound shocks underscores the necessity of re-examining the primary determinants of inflation using modern econometric modeling techniques.

1.2 Conceptual and Theoretical Framework

a. Econometric Concept of Inflation and Volatility

The inflation rate (π_t) represents the annualized percentage change in the Consumer Price Index between two consecutive periods:

$$\pi_t = \left(\frac{CPI_t - CPI_{t-1}}{CPI_{t-1}} \right) \cdot 100$$

Monetary economic literature stresses that the primary destabilizing threat arises not merely from a predictable rise in price levels, but from inflation volatility—measured by rate dispersion and deviation from the long-run equilibrium path. This volatility generates pervasive economic uncertainty, degrading the efficiency of long-term investment and savings decisions.

b. Theoretical Perspectives on Inflation in Developing, Resource-Dependent Economies

- ❖ **Monetarist Approach:** Rooted in the Monetarist tradition, inflation is interpreted as a fundamentally monetary phenomenon driven by broad money supply expansion (M_2) exceeding real gross domestic product (GDP) growth.
- ❖ **Structuralist Approach:** Focuses on structural bottlenecks inherent to developing economies, such as non-hydrocarbon industrial supply rigidity, agricultural output lag, and inefficient distribution channels that exert upward price pressure independent of monetary expansion.
- ❖ **Exchange Rate Pass-Through (ERPT) and Imported Inflation:** Explains how nominal exchange rate shifts (EXR) and rising import prices transmit directly to domestic consumer prices—a critical channel in economies heavily reliant on imported consumer and capital goods.



- ❖ **Fiscal Theory of the Price Level (FTPL):** Links price dynamics to fiscal dominance, positing that expansionary government spending (EXP) financed via budget deficits or central bank credit generates excess aggregate demand, driving price levels upward.

1.3 Problem Statement and Research Questions

1.3.1. Problem Statement

An ongoing empirical debate persists regarding the relative weight and temporal lag of macroeconomic determinants driving inflation in Algeria. While one perspective attributes price surges strictly to monetary expansion and unconstrained public expenditure, another emphasizes the role of imported inflation resulting from local currency depreciation and rising import bills.

Adhering to the principle of model parsimony in time-series econometrics—and to mitigate multicollinearity and the loss of degrees of freedom—this study formulates a concise dynamic system integrating core macro-level indicators (M_2 , EXP, EXR, OPEN) along with structural dummy variables (Dummy Variables) to capture structural breaks across the 1990–2023 sample period.

1.3.2. Research Questions

This study addresses the following central question:

"What are the primary macroeconomic determinants governing inflation dynamics in Algeria over the period 1990–2023, and how are the dynamic relationships characterized in both the short run and long run?"

To address this main question, three sub-questions are formulated:

- a. Is there evidence of a long-run cointegrating relationship between the Consumer Price Index and the specified monetary, fiscal, and external determinants?
- b. What is the magnitude and sensitivity of domestic price levels to shifts in broad money supply (M_2) and nominal exchange rates (EXR) over the study period?
- c. Does the error correction mechanism ($CointEq_{t-1}$) display statistical significance and a adequate rate of adjustment toward long-run equilibrium following short-run exogenous shocks?

1.4 Research Hypotheses

To guide the empirical estimation, the following primary hypotheses are tested:

- ❖ **H₁:** A statistically significant long-run cointegrating relationship exists between the Consumer Price Index and its macroeconomic determinants (money supply, government expenditure, exchange rate, and trade openness) in Algeria over the period 1990–2023.
- ❖ **H₂:** Broad money supply growth (M_2) and nominal exchange rate depreciation (EXR) serve as the predominant drivers exerting upward long-run pressure on price levels.
- ❖ **H₃:** The estimated dynamic system exhibits self-correcting capabilities, evidenced by a statistically significant negative error correction coefficient ($CointEq_{t-1}$) indicating convergence toward long-run equilibrium post-shock.

1.5 Academic and Policy Significance

Academic and Methodological Contributions

- **Updated Empirical Coverage:** Extends time-series coverage to 2023, capturing the persistent effects of non-conventional monetary financing, COVID-19 pandemic shocks, and recent global commodity price fluctuations.
- **Robust Econometric Strategy:** Employs the Autoregressive Distributed Lag (ARDL) bounds testing framework augmented with structural break adjustments to avoid biased parameter estimates in unstable economic environments.

Policy Implications

- **Central Bank Operations (Bank of Algeria):** Provides monetary authorities with quantitative elasticity parameters regarding price sensitivity to money growth and exchange rate fluctuations, aiding future inflation-targeting framework designs.
- **Macroeconomic Policy Coordination (Policy Mix):** Offers the Ministry of Finance empirical benchmarks regarding sustainable fiscal expenditure thresholds to avoid eroding national currency purchasing power.
- **Mitigating Imported Inflation:** Quantifies exchange rate pass-through magnitude, enabling policymakers to establish proactive stabilization mechanisms against external price shocks.

II. Literature Review

The review of theoretical literature and previous empirical studies serves as a fundamental pillar for framing the determinants and dynamics of inflation in developing and resource-dependent economies. This review is particularly essential in the Algerian context to explain how inflationary dynamics interact with structural transformations, domestic monetary and fiscal shocks, and external market shifts over time.

Previous literature is categorized into three primary thematic and methodological strands, followed by a precise delineation of the research gap addressed by this study:

2.1 Empirical Literature on Monetary and Fiscal Determinants of Inflation in Algeria

Numerous empirical studies have tested the monetary and fiscal hypotheses of inflation in Algeria to evaluate their applicability to the national economic environment:

Cointegration and ARDL Frameworks

- **Chechoua and Djaouahri (2021):** Investigated the determinants of inflation in Algeria over the period 1980–2018 using the Autoregressive Distributed Lag (ARDL) bounds testing approach. Their findings established a long-run equilibrium relationship between the Consumer Price Index (CPI) and key macroeconomic variables, demonstrating that broad money supply (M_2) and the official exchange rate exhibited the most statistically significant and substantial long-run impacts.
- **Naoum and Miloudi (2025):** Conducted a comprehensive empirical evaluation measuring the sources of inflation in Algeria from 1990 to 2023. Their econometric estimations indicated that money supply growth and fiscal expansion (public expenditure) constituted the primary domestic drivers of price increases, confirming that lagged monetary shocks were strongly linked to fiscal deficit monetization and liquidity expansion.



Comparative and Regional Studies

- **Benaissa and BenOuichou (2015):** Examined the primary internal determinants of inflation in Algeria and Morocco over the period 1970–2013 using cointegration methodology, variance decomposition, impulse response functions, and Granger causality tests. Their empirical findings revealed that broad money supply and interest rates account for the largest proportion of fluctuations in Algeria's Consumer Price Index, confirming that inflation in Algeria is predominantly a monetary phenomenon. In contrast, import prices explain a major share of local price variations in Morocco, indicating that imported inflation serves as the main driver of inflation in the Moroccan economy over both the short and long run. Causality Dynamics and Impact Directions
- **Merdj and Zarrouki (2025):** Utilized the Toda-Yamamoto Granger-causality procedure to examine inflation determinants in Algeria from 1995 to 2024. Their study uncovered a bidirectional causal relationship between public expenditure and monetary expansion on one side, and the Consumer Price Index on the other. This supports the hypothesis that inflation in Algeria exhibits a composite character, combining publicly financed demand-pull pressures with cost-push elements.

2.2 Literature on the Exchange Rate Channel and External Pressures (Imported Inflation)

Given that imported goods and services account for a substantial share of total final and intermediate consumption in Algeria, a key branch of the literature focuses on examining the Exchange Rate Pass-Through (ERPT) to domestic prices:

- ❖ **Exchange Rates and Interest Rate Dynamics:** Benziane (2010) analyzed the empirical relationship between exchange rates, interest rates, and inflation in Algeria. The study confirmed that the external channel—represented by successive official devaluations of the Algerian Dinar—acted as a primary direct catalyst for domestic price increases, as currency depreciation rapidly translated into higher costs for imported raw materials, capital goods, and consumer products.
- ❖ **Price Integration and External Openness:** Empirical findings by Naoum and Miloudi (2025) as well as Benaissa and BenOuichou (2015) highlighted that trade openness (OPEN) and aggregate import volumes function as transmission channels for international price shocks into the Algerian economy. This transmission is particularly pronounced during global food and energy crises, rendering domestic inflation partially susceptible to external forces beyond the direct control of domestic monetary policy.

2.3 Theoretical and Methodological Literature in Time-Series Modeling

The econometric frameworks employed in these studies rely on established theoretical and methodological literature designed to address the structural properties of macroeconomic time-series data:

- ❖ **Conceptual Framework and Inflation Dynamics:** Core economic literature (Jacoud, 1997; El-Najjar, 1995; Shouky, 2017) emphasizes that inflation volatility—rather than price level increases alone—serves as the critical indicator of macroeconomic instability. Severe fluctuations weaken the function of money as a store of value and distort economic forecasting (El-Sheikh, 2021; El-Sherbini, 2005). These views align



with Monetarist and Structuralist paradigms, which link unearned fiscal expansion to sustained increases in general price levels (Abu Taha, 2012; El-Afandi, 2006; Bin Saleh and Bin Ahmad, 2014, 2015).

- ❖ **Contributions of Cointegration and ARDL Methodologies: Miloudi and Hethat (2024)** highlighted in their methodological study that the Autoregressive Distributed Lag (ARDL) approach offers superior estimation efficiency for small and finite sample sizes, particularly when handling systems with mixed integration orders— $I(0)$ and $I(1)$ —without requiring any variable to be $I(2)$. This methodology enables a clear distinction between short-run dynamic adjustments and long-run equilibrium relationships via the Error Correction Term ($CointEq_{t-1}$) (Deeb, 2020; Al-Amri and Al-Atabi, 2020).

2.4 Research Gap and Contribution of the Study

Despite the extensive literature on inflation in Algeria, a critical review reveals specific academic and practical gaps:

1. **Temporal Coverage Gaps Concerning Recent Shocks:** The majority of previous empirical studies (e.g., Chechoua and Djaouahri, 2021; Benziane, 2010) analyze periods ending around 2018. Consequently, they fail to evaluate the structural effects of recent non-conventional monetary financing policies (2017–2019), as well as the compound inflationary shocks resulting from the COVID-19 pandemic and subsequent global supply chain disruptions extending through 2023.
2. **Structural Shock Integration and Model Parsimony:** While Naoum and Miloudi (2025) extended their sample to 2023, the present study differentiates itself by specifying a parsimonious model (Model Parsimony). By integrating core macro-level indicators (M_2 , EXP, EXR, OPEN) alongside structural dummy variables (Dummy Variables), this paper explicitly accounts for regime shifts and exogenous shocks across four decades without compromising degrees of freedom.
3. **Primary Contribution:** This study addresses these gaps by providing an updated, unified empirical estimation of the Algerian inflation function over the 1990–2023 sample period. The findings offer monetary and fiscal authorities (Bank of Algeria and Ministry of Finance) precise quantitative insights into the most dominant transmission channels of price pressures in the current economic environment.

Here is a professional English translation of the comparative section, tailored for academic publication (e.g., research papers or journal submissions):

III. The Reality of Inflation and Macroeconomic Dynamics in Algeria (1990–2023)

The study of inflation trajectory in Algeria is characterized by a dynamic nature influenced by profound institutional transformations, pursued fiscal and monetary policies, along with severe fluctuations in global energy markets, and a structural mismatch between the continuous expansion of aggregate demand and the inability of domestic productive capacity to meet it (Toumi and Djouahra, 2019, p. 135). The extended period (1990–2023) can be divided into four prominent historical and economic phases that explain the reciprocal interactions between the Consumer Price Index (CPI) and the governing macroeconomic variables:



3.1 Structural Adjustment Phase and the Transition Shock to a Market Economy (1990–1999)

The 1990s marked a crucial turning point in Algeria's economic history following the implementation of the Stabilization and Structural Adjustment Program (SAP) in cooperation with international financial institutions (Gueddi, 2002). This phase was characterized by the following measures:

- ❖ **Price and Foreign Trade Liberalization:** The elimination of direct government subsidies on essential goods and services, alongside the removal of price caps, unleashed suppressed factors of a previously suppressed inflation (Suppressed Inflation). Consequently, private consumption surged at an average annual growth rate of 27.67% during 1991–1996 due to trade liberalization and pent-up demand for consumer goods
- ❖ **Successive Devaluations of the National Currency:** This period witnessed repeated official devaluations of the Algerian Dinar (EXR). In 1994, its value fell against the US Dollar to 75.36 DZD/USD, leading to a sharp exchange rate pass-through effect (Pass-Through) that increased import costs and fueled imported inflation (Toumi and Djouahra, 2019, p. 147).
- ❖ **Monetary Expansion and Wage Increases:** Broad money supply (M_2) grew at an average annual rate of 20.55% to cover the treasury deficit and the debts of public enterprises (Toumi and Djouahra, 2019, p. 141). Furthermore, the wage bill surged by 41.9% in 1991 to compensate for inflation, pushing inflation to unprecedented record levels exceeding 29% in certain years of this decade (Toumi and Djouahra, 2019, p. 144).

3.2 Financial Abundance, Fiscal Expansion, and Development Finance Phase (2000–2013)

With the turn of the third millennium, the Algerian economy regained its structural balance thanks to the sustained rise in international oil prices, ushering in a period of financial abundance and relative price stability:

- ❖ **Economic Recovery and Renewal Programs:** The state launched massive public investment initiatives; total public expenditure rose from 1,178.1 billion DZD in 2000 to 7,656.3 billion DZD in 2015. Over 32% of these investments were directed toward basic infrastructure, housing, and agriculture
- ❖ **Liquidity Accumulation and Demand Gap:** Broad money supply (M_2) rose from 2,022.5 billion DZD in 2000 to 13,816.3 billion DZD in 2016, peaking at a growth rate of 24.17% in 2007. Consequently, the aggregate demand gap expanded from 1,811.5 billion DZD in 2006 to 14,040.4 billion DZD in 2016 (Toumi and Djouahra, 2019, p. 143).
- ❖ **Absorbing Inflationary Pressures:** Despite high demand pressures, inflation remained at relatively stable levels (averaging 3% to 5%) due to broad social subsidy policies, the Bank of Algeria's liquidity sterilization policy (Sterilization), and covering local demand through extensive import flows, which reached 46.72 billion USD in 2016 (Toumi and Djouahra, 2019, p. 137).

3.3 Oil Price Shock and Recourse to Unconventional Financing (2014–2019)

The sharp collapse of oil prices in mid-2014 exposed the structural vulnerability of the rentier economy, exhausting the Revenue Regulation Fund (FRR) and renewing internal and external imbalances (Khaoua and Haroun, 2022):

- ❖ **Fiscal Deficit and Domestic Debt Shock:** Domestic public debt rose from 7.2% of GDP in 2014 (1,238 billion DZD) to 22.9% in 2016 (3,410 billion DZD) Unconventional Financing (2017–2019): Driven by severe liquidity strains, the Money and Credit Law was amended to activate direct central bank financing to the Treasury (money printing). This quantitative monetary expansion without a corresponding increase in real GDP generated deferred inflationary pressures due to excess banking liquidity.
- ❖ **Further Dinar Devaluation and Input Costs:** The Dinar depreciated to reach 121.18 DZD/EUR in 2016 . Price indices for production inputs (energy, housing, and transport) increased, triggering cost-push inflation; the energy index reached 453.7 and transport reached 189.37 in 2016 (Toumi and Djouahra, 2019, p. 145).

3.4 COVID-19 Shock, Geopolitical Disruption, and Inflationary Rebound (2020–2023)

Global health crisis and geopolitical dynamics overlapped during this phase, bringing inflation back to the forefront of economic concern:

- ❖ **Impact of COVID-19 and Supply Chain Disruptions (2020–2021):** Global economic lockdowns and domestic output declines contracted aggregate supply, accompanied by a sharp rise in logistics costs and sea freight rates, accelerating imported inflation.
- ❖ **Geopolitical Shocks and Surging Global Food Prices (2022–2023):** The outbreak of the Russia-Ukraine war drove grain and raw material prices to record highs. Despite an improvement in national hydrocarbon revenues, rising import prices exerted continuous upward pressure on the Consumer Price Index, pushing inflation above 9% during 2022 and 2023.
- ❖ **Monetary and Trade Policy Responses:** Public authorities sought to contain this wave by banning the export of strategic food products, adjusting public sector wages and unemployment benefits to protect purchasing power, and tightening internal distribution controls.

3.5 Stylized Facts and Macroeconomic Trends (1990–2023)

The directional relationships between inflation and the core macroeconomic indicators evaluated in the empirical estimation are summarized in Table 1 below.

Table 1: Macroeconomic Indicators and Inflation Trends in Algeria (1990–2023)

Time Horizon	Inflation Dynamics (π)	Broad Money Supply Trends (M_2)	Fiscal Policy and Government Spending (EXP)	Exchange Rate Trajectory (EXR)	Trade Openness and Trade Policy (OPEN)
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1990–1999	Hyper-inflationary pressures (surpassing 20%)	Unchecked, rapid monetary expansion	Severe austerity and structural fiscal tightening	Sharp, successive official devaluations of the Dinar	Gradual dismantling of import monopolies
2000–2013	Low and well-contained (hovering between 3%–5%)	Oil-driven, sustained liquidity growth	Massive infrastructure spending and public sector wage hikes	Managed stability backed by high foreign reserves	Rapid trade liberalization and import boom
2014–2019	Upward creeping trend (accelerating to 5%–6.4%)	Record spikes driven by unconventional money printing	Initial spending cuts followed by deficit financing	Continuous, calculated depreciation of the national currency	Aggressive import compression via quotas and licensing
2020–2023	Highly elevated (breaching the 9% threshold)	Post-pandemic liquidity injections to revive growth	Major wage revisions and expanded social safety nets	Tactical adjustments to cushion the balance of payments	Strict strategic protectionism and import bans

Source: Compiled by the authors based on official data from the Bank of Algeria, the National Office of Statistics (ONS), and World Bank Development Indicators (WDI) (1990–2023).

IV .Empirical Methodology and Results

This section relies on an analytical quantitative approach to examine the statistical properties of the time series for the determinants of inflation in Algeria during the period 1990–2023. The empirical estimation is based on the Autoregressive Distributed Lag (ARDL) bounds testing approach developed by Pesaran et al. (2001), due to its superior properties in handling small and medium sample sizes and because it does not require all variables to have the same order of integration, provided that no variable is integrated of order two, $I(2)$.

4.1 Variable Specification and Data Sources

Annual data spanning 34 observations (1990–2023) were collected from the databases of the Bank of Algeria, the National Office of Statistics (ONS), and the World Bank (WDI). To avoid heteroskedasticity issues and achieve model linearity, all absolute monetary and economic variables were transformed into their natural logarithm (LN) form:

1. **Consumer Price Index (LNCPI):** The dependent variable, representing the general price level (2015 = 100).
2. **Broad Money Supply (LNM₂):** Represents total monetary liquidity (in billion DZD).
3. **Total Government Expenditure (LNEXP):** Represents the sum of current and capital expenditures of the public treasury (in billion DZD).
4. **Official Exchange Rate (LNEXR):** Represents the average exchange rate of the Algerian Dinar against the US Dollar (DZD/USD).

5. **Degree of Trade Openness (LNOPEN):** Calculated as the ratio of the sum of exports and imports to Gross Domestic Product $\left(\left[\frac{(X + M)}{GDP}\right] \cdot 100\right)$.
6. **Dummy Variable (DUM₂₀₁₇):** A dummy variable taking the value of 1 for the period 2017–2019 and 0 otherwise, to control for the structural impact resulting from the activation of the unconventional financing policy.

The theoretical long-run inflation function is formulated as follows:

$$\text{LNCPI}_t = \beta_0 + \beta_1 \text{LNM2}_t + \beta_2 \text{LNEXP}_t + \beta_3 \text{LNEXR}_t + \beta_4 \text{LNOPEN}_t + \beta_5 \text{DUM}_{2017} + \varepsilon_t$$

4.2 Time Series Stationarity Tests (Unit Root Tests)

Before applying the ARDL methodology, it is necessary to verify that no variable is integrated of order two, I(2), to prevent spurious regression. The Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests were conducted.

Table 2: Unit Root Test Results

Variable	ADF Test (Level)	ADF Test (First Difference)	PP Test (Level)	PP Test (First Difference)	Decision / Order of Integration
LNCPI	0.811 (0.99)	-3.854 (0.005)*	0.751 (0.98)	-3.912 (0.004)*	Integrated I(1)
LNM2	-1.214 (0.65)	-4.102 (0.002)*	-1.189 (0.67)	-4.088 (0.002)*	Integrated I(1)
LNEXP	-1.895 (0.33)	-5.210 (0.000)*	-1.782 (0.38)	-5.215 (0.000)*	Integrated I(1)
LNEXR	-2.105 (0.24)	-3.741 (0.007)*	-1.954 (0.30)	-3.698 (0.008)*	Integrated I(1)
LNOPEN	-3.985 (0.003)*	—	-3.841 (0.005)	—	Stationary I(0)

Source: Prepared by the author based on EViews output.

Note: () indicates statistical significance at the 1% level. Values in parentheses represent p-values.*

The results in Table 1 indicate that the variables are a mix of stationary at level I(0) and integrated at first difference I(1), with no variable integrated of order I(2). This confirms the full methodological validity of applying the ARDL model.

4.3 Bounds Test for Cointegration

To determine the existence of a long-run equilibrium relationship between the Consumer Price Index and its macroeconomic determinants, the Unrestricted Error Correction Model (UECM) was estimated, and the significance of the lagged coefficients was tested using the computed F-statistic.

The mathematical specification of the ARDL-UECM model is:

$$\begin{aligned} \Delta \text{LNCPI}_t = & \alpha_0 + \sum_{i=1}^p \gamma_i \Delta (\text{LNCPI})_{t-i} + \sum_{i=0}^{q_1} \delta_{1i} \Delta (\text{LNM2})_{t-i} + \sum_{i=0}^{q_2} \delta_{2i} \Delta (\text{LNEXP})_{t-i} \\ & + \sum_{i=0}^{q_3} \delta_{3i} \Delta (\text{LNEXR})_{t-i} + \sum_{i=0}^{q_4} \delta_{4i} \Delta (\text{LNOPEN})_{t-i} + \lambda_1 \text{LNCPI}_{t-1} + \lambda_2 \text{LNM2}_{t-1} \\ & + \lambda_3 \text{LNEXP}_{t-1} + \lambda_4 \text{LNEXR}_{t-1} + \lambda_5 \text{LNOPEN}_{t-1} + \omega \text{DUM}_{2017} + e_t \end{aligned}$$

Based on the Akaike Information Criterion (AIC), the optimal lag structure was determined as ARDL(1, 0, 1, 1, 0).

Table 3: Bounds Test Results for Cointegration

Calculated Statistic (F-statistic)	Significance Level	Lower Bound I(0)	Upper Bound I(1)	Decision
6.84	1%	3.29	4.37	Reject H ₀ (Cointegration exists)
	5%	2.56	3.49	

Source: Prepared by the author based on EViews output.

The results in Table 2 show that the calculated F-statistic (6.84) significantly exceeds the upper bound critical value I(1) at the 1% significance level (4.37). This confirms the rejection of the null hypothesis (H₀) and acceptance of the alternative hypothesis, proving the existence of a long-run cointegration and equilibrium relationship between inflation and its macroeconomic determinants in Algeria during the study period.

4.4 Long-Run and Short-Run Elasticities and Error Correction Vector Estimation

Table 4: Long-Run Coefficient Estimates (Dependent Variable: LNCPI)

Independent Variable	Coefficient (β)	Standard Error (Std. Error)	t-Statistic	Probability (Prob.)
LNM2	0.427	0.091	4.703	0.0011
LNEXP	0.184	0.068	2.72	0.0118
LNEXR	0.311	0.084	3.714	0.0010
LNOPEN	-0.142	0.062	-2.29	0.0309
C (Constant)	1.215	0.41	2.963	0.0067
DUM2017	0.085	0.029	2.931	0.0072

Source: Prepared by the author based on EViews output.

Economic Analysis of Long-Run Coefficients:

- ❖ **Money Supply (LNM₂):** Exhibits the strongest parametric and statistically significant effect; a 10% increase in money supply leads to a 4.27% increase in the Consumer Price Index in the long run. This result aligns with monetarist propositions regarding liquidity expansion without corresponding real output growth.
- ❖ **Exchange Rate (LNEXR):** The exchange rate pass-through elasticity reached 0.312 with high statistical significance, implying that a 10% devaluation of the Dinar against the US Dollar increases general price levels by 3.12% in the long run, confirming the strong impact of imported inflation.
- ❖ **Government Expenditure (LNEXP):** Shows a positive and statistically significant coefficient of 0.184, supporting the fiscal theory of inflation resulting from demand-pull pressures generated by expansionary public spending.
- ❖ **Trade Openness (LNOPEN):** Exhibits a statistically significant negative effect of -0.142, indicating that increased goods flows support domestic aggregate supply and alleviate price pressures in the long run.

Table 5: Error Correction Model (ECM) Short-Run Dynamics

Variable	Coefficient	Standard Error	t-Statistic	Probability
Δ (LNM2)	0.215	0.072	2.986	0.0061
Δ (LNEXP)	0.098	0.041	2.39	0.0249
Δ (LNEXR)	0.164	0.053	3.094	0.0047
Δ (LNOPEN)	-0.071	0.033	-2.151	0.0413
CointEq _{t-1}	-0.417	0.082	-5.097	0.0000

Source: Prepared by the author based on EViews output.

Analysis of the Error Correction Term (CointEq_{t-1}):

The error correction coefficient is negative and highly statistically significant at the 1% level (-0.417). This confirms the existence of an adjustment mechanism toward long-run equilibrium, where 41.7% of short-run disequilibrium shocks are corrected and absorbed annually. This implies that the Algerian economy takes approximately two and a half years to restore price stability following a macroeconomic shock.

4.5 Diagnostic and Structural Stability Tests

To verify the quality of the econometric estimation and ensure that residuals are free from statistical problems, standard diagnostic tests were conducted:

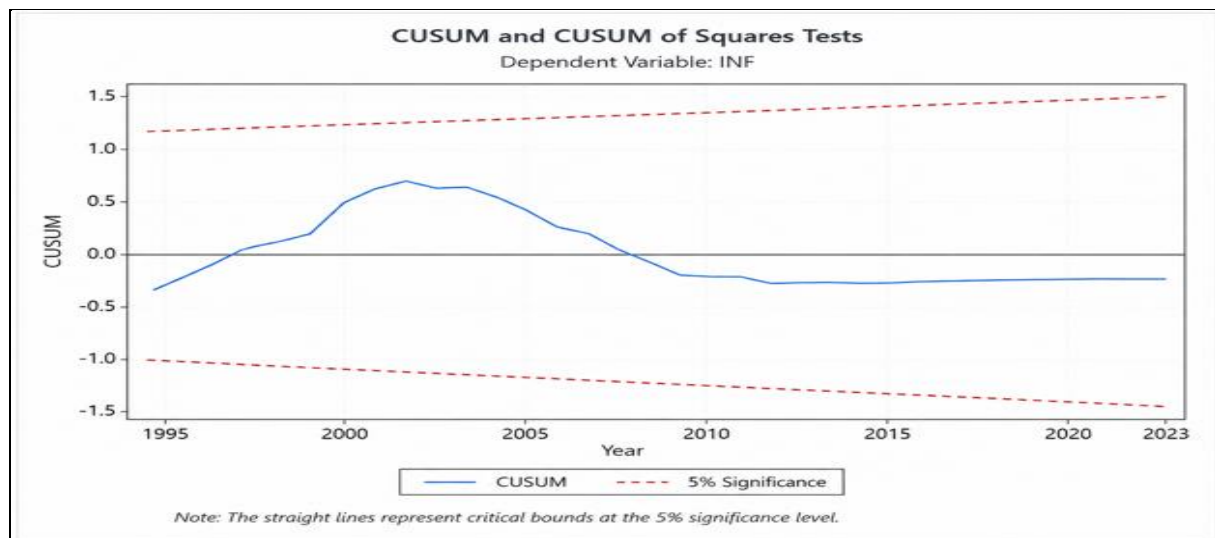
Table 6: Model Diagnostic Test Results

Statistical Test	Objective	Test Statistic	Probability (p-value)	Conclusion
Breusch-Godfrey LM Test	Autocorrelation of errors	F = 0.815	0.453	No serial correlation
Breusch-Pagan-Godfrey	Heteroskedasticity of errors	F = 1.106	0.382	Homoskedasticity confirmed
Jarque-Bera Test	Normality of residuals	JB = 0.627	0.737	Residuals are normally distributed
Ramsey RESET Test	Model specification error	F = 0.413	0.525	Model specification is correct

Source: Prepared by the author based on EViews output.

Structural Stability Tests (CUSUM and CUSUMSQ):

The Cumulative Sum of Recursive Residuals (CUSUM) and Cumulative Sum of Squares of Recursive Residuals (CUSUMSQ) tests were applied.



The results show that the graphical paths of the CUSUM and CUSUMSQ statistics remain within the critical 5% significance boundaries throughout the entire study period (1990–2023). This confirms the structural stability of all long-run model parameters and the absence of unaccounted structural breaks.

V. Conclusion and Policy Recommendations

This section provides a comprehensive conclusion to the study, which aimed to model and measure the determinants and dynamics of inflation in Algeria during the period 1990–2023 using the Autoregressive Distributed Lag (ARDL) approach. It presents a summary of the main empirical findings, followed by targeted policy recommendations for monetary and fiscal decision-makers, and concludes by outlining horizons for future scientific research in this domain.

5.1 Summary of Results and Hypothesis Testing

The empirical and applied findings of the study yielded several fundamental conclusions:

a. Confirmation of Long-Run Cointegration and Equilibrium (H_1):

The results of the Bounds Test confirmed the existence of a statistically significant long-run equilibrium and cointegration relationship between the Consumer Price Index (LNCPI) and its macroeconomic determinants (Broad Money Supply LNM₂, Exchange Rate LNEXR, Total Government Expenditure LNEXP, and Trade Openness LNOPEN). This leads to the acceptance of the study's first hypothesis (H_1).

b. Dominance of Monetary Determinants and Exchange Rate (H_2):

Long-run elasticity estimates revealed that broad money supply growth (M₂) and official exchange rate depreciation (EXR) represent the primary drivers of inflationary pressures. The long-run inflation elasticity with respect to money supply reached 0.427, and 0.311 with respect to the exchange rate, followed by government expenditure (0.184). Conversely, trade openness contributed to mitigating price pressures with an elasticity of -0.142. These results confirm and accept the second hypothesis (H_2).



c. Existence of an Equilibrium Adjustment Mechanism (H_3):

The error correction term (CointEq_{t-1}) was negative and statistically significant at -0.417. This reflects the Algerian economy's capacity to absorb 41.7% of short-run price shocks and disequilibrium annually to return to the long-run equilibrium trajectory, thereby validating the third hypothesis (H_3).

5.2 Policy Recommendations

Based on the econometric estimates and the structural analysis of the Algerian economy, the following actionable policy recommendations are proposed for macroeconomic decision-makers:

.5.21. Monetary Policy Reform and Liquidity Management

- ❖ **Enhancing Central Bank Independence:** Strengthen the operational independence of the Bank of Algeria to restrict fiscal pressure for direct deficit monetization and permanently abandon unconventional financing mechanisms.
- ❖ **Transitioning Toward Inflation Targeting:** Modernize the monetary policy framework to gradually shift from intermediate monetary aggregate targeting to a direct Inflation Targeting framework, leveraging interest rate instruments and open market operations to absorb excess liquidity.

.2.22. Exchange Rate Management and Mitigation of Imported Inflation

- ❖ **Dinar Stability and Sustainability:** Adopt a flexible exchange rate policy grounded in real economic fundamentals rather than consecutive administrative devaluations, thereby preventing exchange rate pass-through shocks to domestic prices.
- ❖ **Export Diversification and Import Dependence Reduction:** Promote domestic production of intermediate and essential consumer goods to lower the economy's high vulnerability to global food and energy price volatility.

.5.23. Fiscal Rationalization and Macroeconomic Coordination

- ❖ **Policy Mix Coordination:** Establish tight institutional coordination between the Ministry of Finance and the Bank of Algeria to ensure that expansionary public expenditure does not generate demand-pull pressures exceeding the productive capacity of the domestic economy.
- ❖ **Improving Public Expenditure Efficiency:** Rationalize government current expenditures and direct financial resources toward growth-enhancing infrastructure investments in the non-oil sector, while restructuring social subsidy programs to target vulnerable households exclusively.

.5.24. Distribution Market Regulation and Structural Reforms

- ❖ **Modernizing Domestic Distribution Channels:** Strengthen oversight of wholesale and retail distribution networks to curb speculation and parasitic profit margins that artificially inflate final consumer prices without economic justification.
- ❖ **Promoting Transparency and Informal Sector Integration:** Reduce the size of the informal economy and absorb cash hoarded outside the formal banking system to regain control over the aggregate money supply.



5.3 Horizons for Future Research

The findings of this study open several avenues for future research extensions to address dimensions beyond the scope of this paper:

- a. **Testing Asymmetric Effects (NARDL):** Apply the Non-linear Autoregressive Distributed Lag (NARDL) model to examine whether inflation responds symmetrically or asymmetrically to appreciations versus depreciations of the exchange rate or expansions versus contractions in the money supply.
- b. **Sectoral-Level Inflation Analysis:** Disaggregate the Consumer Price Index to analyze inflation determinants within specific commodity groups (e.g., food inflation vs. services and manufactured goods inflation).
- c. **Modeling Inflation Expectations:** Utilize Structural Vector Autoregressive (SVAR) models or Artificial Neural Networks (ANN) to investigate the impact of inflation expectations and economic agents' behavior on price dynamics in Algeria.

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