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THE IMPACT OF PARALLEL EXCHANGE RATE ON INFLATION IN ALGERIA (2000-2024)

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ABSTRACT

This study investigates the long-run and short-run impact of the parallel exchange rate on inflation in Algeria over the period 2000–2024. Using annual time-series data and the autoregressive distributed lag bounds testing approach, we estimate dynamic relationships while accommodating mixed integration orders. Results confirm cointegration between the variables, with a long-run elasticity of 0.43, indicating that a 1% depreciation in the parallel market raises inflation by 0.43 percentage points. The error-correction term of -0.32 indicates that approximately 32% of the disequilibrium is corrected annually. Diagnostic and sensitivity analyses, including Chow breakpoint tests and rolling-window estimates, validate the model's stability and robustness. The findings underscore the structural role of informal exchange rate dynamics in driving domestic price pressures, particularly following the 2014 oil price shock. Policymakers, central bankers, and researchers focused on macroeconomic stabilization in resource-dependent economies will find these results instrumental for designing exchange rate reforms, inflation-targeting frameworks, and structural diversification strategies aimed at reducing vulnerability to external shocks and informal market volatility.

1 INTRODUCTION

Algeria, one of North Africa's largest economies, remains structurally dependent on hydrocarbon exports, which historically account for over 90% of export earnings and approximately 60% of fiscal revenue. (World Bank Group, 2026) This commodity reliance has profoundly shaped macroeconomic management, particularly in foreign exchange and monetary policy. Since the early 2000s, the Bank of Algeria has maintained a managed float regime for the official dinar exchange rate, while stringent capital controls and limited access to formal foreign currency markets have sustained a vibrant parallel (informal) exchange market. (International Monetary Fund, 2025) The resulting dual exchange rate system has generated persistent distortions, notably through the inflationary channel, as imported goods and intermediate inputs are increasingly priced according to parallel market dynamics rather than official rates. (Arab Monetary Fund, 2021) While the official rate is administratively stabilized to preserve reserves, the parallel rate

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exhibits pronounced depreciation, reflecting underlying supply-demand imbalances and shifting market confidence (Bouteldja & Benbekhti, 2024). Despite extensive literature on exchange rate pass-through in emerging economies, empirical evidence on the long-run and short-run effects of Algeria's parallel exchange rate on domestic inflation remains fragmented, particularly across structural breaks such as the 2014 oil price shock and the 2020 pandemic. This study addresses this gap by rigorously examining the dynamic relationship between parallel exchange rate fluctuations and inflation in Algeria over the 2000–2024 period, employing robust time-series econometric techniques to inform evidence-based monetary and exchange rate policy.

1.1 Research Problem

The coexistence of official and parallel exchange rates in Algeria has created a persistent premium that undermines monetary policy effectiveness and fuels inflationary pressures. Despite the central bank's efforts to stabilize the dinar through reserve accumulation and import restrictions, the parallel market continues to reflect actual currency valuation, driving up the cost of imported essentials and intermediate goods. This exchange rate duality not only distorts price signals but also complicates inflation management and macroeconomic stability. Existing studies have focused on short-term fluctuations, relied on outdated or incomplete data, or examined the official exchange rate while neglecting the parallel market's growing influence. Consequently, there is a critical lack of comprehensive, long-run empirical analysis quantifying the pass-through effect of parallel exchange rate depreciation on Algeria's inflation trajectory, particularly in the context of recent external shocks, fiscal constraints, and structural economic vulnerabilities. This research problem motivates the need for a rigorous econometric investigation to isolate the inflationary impact of the parallel exchange rate and assess its implications for policy formulation.

1.2 Research Objectives

To address the identified research problem, this study pursues the following specific objectives:

- To examine the long-run and short-run dynamic relationship between the parallel exchange rate and inflation in Algeria over the period 2000–2024.
- To quantify the exchange rate pass-through elasticity from the parallel market to domestic consumer prices using the Autoregressive Distributed Lag (ARDL) bounds testing approach.
- To assess the speed of adjustment toward long-run equilibrium and evaluate the stability of the estimated relationship through comprehensive diagnostic and sensitivity analyses.
- To derive evidence-based policy recommendations for monetary authorities regarding exchange rate management, inflation control, and structural reforms aimed at reducing dual-market distortions.

2 THEORETICAL FRAMEWORK AND LITERATURE REVIEW

In this section, we will review the key concepts of the parallel exchange rate and inflation, which constitute the core variables of this study. Given their central role in the analysis, it is essential to establish a comprehensive theoretical foundation by examining how these concepts have been defined, operationalized, and empirically investigated in existing literature. This conceptual clarification is particularly important in the context of developing economies like Algeria, where both variables exhibit distinctive characteristics shaped by institutional arrangements, policy frameworks, and structural constraints. By synthesizing insights from prior theoretical and empirical research, this section aims to delineate the conceptual boundaries of the parallel exchange rate and inflation, clarify their measurement approaches, and identify the mechanisms through which they interact.

2.1 Parallel Exchange Rate: Concept and Models

The parallel exchange rate is broadly defined as a market-determined currency price that operates alongside an official, administratively set rate, typically emerging in economies with foreign exchange restrictions, capital controls, or limited access to formal currency markets (Kiguel & Stephen, 1994). In the African context, parallel

foreign exchange markets are characterized by the coexistence of official and informal rates used interchangeably in trade and financial transactions, reflecting underlying supply-demand imbalances unaddressed by official policy (Fofack & Nolan, 2001). Latin American scholarship frequently refers to this phenomenon as the "black market exchange rate," arising when governments impose capital controls that create excess demand for foreign currency, thereby fostering informal trading (Hassanain, 2005). The International Monetary Fund characterizes such markets as mechanisms through which domestic currencies experience de facto external depreciation beyond official valuations (Nowak, 1985). More generally, the parallel rate is understood as any exchange rate that diverges from the government-mandated official rate, with the "parallel premium" quantified as the percentage by which the informal rate exceeds the official one (Katusiime, 2025). Contemporary research further notes that informal value transfer systems, including hawala networks in the Middle East and South Asia, facilitate currency conversion outside formal channels, reinforcing the persistence of parallel rates in developing economies (Khurram , Farooqi , Kassim, & Zain, 2021). Collectively, the literature underscores that dual exchange rate regimes reflect structural disequilibria wherein a single currency assumes distinct values for different transaction categories, typically emerging when official rates fail to clear the foreign exchange market (Noorbakhsh & Shahrokhi, 1993).

The parallel market exchange rate premium, the percentage divergence between informal and official exchange rates, is explained through several complementary theoretical and empirical frameworks in the economic literature. The monetary approach posits that the premium reflects excess demand for foreign currency driven by domestic monetary expansion, fiscal deficits, and reserve inadequacies relative to official rate commitments (Oluremi, 2015; Miguel et al., 1997). Portfolio balance models extend this by incorporating risk perceptions, capital control intensity, and expectations of future devaluation, arguing that the premium compensates holders of domestic currency for institutional and policy uncertainty (Sebastian & Miguel, 1999; Akdogan et al., 2025). Structuralist perspectives emphasize trade restrictions, import licensing, and foreign exchange rationing as key determinants, whereby the premium emerges as a shadow price reflecting the marginal value of foreign currency in constrained markets (Bleaney & Greenaway, 2001; Tryson , 2026) and (Tryson , 2026). More recent empirical applications employ error-correction and ARDL frameworks to quantify how macroeconomic fundamentals such as oil price volatility, fiscal imbalance, and reserve levels jointly determine premium dynamics over time (Mahfoudi , 2024; Rehman et al., 2025). Collectively, these models underscore that the parallel premium is not merely a market anomaly but a structural signal of underlying disequilibria, institutional credibility, and the effectiveness of exchange rate policy in developing economies.

2.2 Inflation: Concept and Models

Inflation is conventionally defined as a sustained increase in the general price level of goods and services in an economy over time, eroding purchasing power and typically measured by the Consumer Price Index (CPI) or GDP deflator (Binetti, Nuzzi, & Stantcheva , 2024). Structuralist perspectives emphasize that in developing economies, inflation often stems from supply-side bottlenecks, import dependency, and exchange rate volatility rather than purely monetary expansion (Kim, 2023). The parallel exchange rate influences inflation through the exchange rate pass-through (ERPT) channel: depreciation in the informal market raises the domestic currency cost of imported consumer goods and intermediate inputs, which directly transmits to consumer prices in import-dependent economies (Hakura & Choudhri, 2006). This mechanism is particularly pronounced in Algeria, where empirical studies using ARDL and VAR frameworks confirm that exchange rate depreciation, especially in informal markets, exerts significant upward pressure on domestic inflation, reflecting the economy's heavy reliance on imported essentials and limited domestic production capacity. (Mahfoudi, 2024) Similar dynamics have been documented in Nigeria, where parallel market depreciation significantly drove headline inflation during periods of foreign exchange scarcity (Obode & Gini, 2026), underscoring the broader relevance of informal exchange rate dynamics for price stability in resource-dependent, import-reliant economies.

2.3 The Research Gap

Although the relationship between parallel exchange rates and inflation has attracted considerable scholarly attention, the existing literature remains predominantly theoretical or relies on conventional econometric techniques that often fail to capture dynamic long- and short-run interactions. This study addresses this gap by employing the Autoregressive Distributed Lag (ARDL) bounds testing approach to empirically quantify the impact of parallel exchange rate fluctuations on domestic inflation. By simultaneously modeling equilibrium relationships and adjustment dynamics within a single framework, the ARDL methodology provides a more rigorous and policy-relevant assessment, thereby contributing a robust empirical foundation to a field historically dominated by qualitative analysis and static modeling.

2.4 Study Hypotheses

Based on the theoretical framework, research objectives, and econometric methodology outlined in this study, the following hypotheses are formulated to guide the empirical investigation of the relationship between the parallel exchange rate and inflation in Algeria (2000–2024):

2.4.1 Main Hypotheses

H_0: There is no significant long-run relationship between the parallel exchange rate and the inflation rate in Algeria.

H_1: There exists a statistically significant long-run relationship between the parallel exchange rate and the inflation rate in Algeria.

2.4.2 Sub-Hypotheses

H_{1a}: Long-Run Pass-Through Effect: There is a positive and statistically significant long-run effect of the parallel exchange rate on inflation in Algeria.

$H_{1\beta}$: Short-Run Dynamic Adjustment: Fluctuations in the parallel exchange rate exert a significant short-run impact on domestic inflation.

H_{1c}: Error Correction Mechanism: There exists a stable error correction mechanism that systematically adjusts deviations from the long-run equilibrium between the parallel exchange rate and inflation over time.

Table 1. Hypotheses Testing Framework

Hypothesis	Econometric Test	Decision Rule
H_1 / H_0 (Cointegration)	ARDL Bounds F-Test	Reject H_0 if F-stat > Upper Critical Bound at 5%
H_{1a} (Long-Run Coefficient)	ARDL Long-Run Estimates	Reject H_0 if $\beta p_{er} > 0$ and $p < 0.05$
$H_{1\beta}$ (Short-Run Impact)	ECM Short-Run Coefficients	Reject H_0 if $\gamma p_{er} > 0$ and $p < 0.05$
H_{1c} (Error Correction)	ECT Significance in ECM	Reject H_0 if ECT < 0 and $p < 0.05$

3 METHODOLOGY

3.1 Research Design

This study adopts a quantitative, explanatory research design grounded in time-series econometrics to empirically examine the dynamic relationship between the parallel exchange rate and inflation in Algeria over the period 2000–2024. Utilizing annual secondary data sourced from the Bank of Algeria (2025), the World Bank (2025), and International Monetary Fund databases (2024), the analysis employs the Autoregressive Distributed Lag (ARDL) bounds testing approach selected for its robustness in handling variables with mixed orders of integration to estimate both long-run equilibrium relationships and short-run adjustment dynamics (Emeka & Uko, 2016). The parallel exchange rate (DA/USD) serves as the primary independent variable, while the annual consumer price inflation rate constitutes the dependent variable; supplementary control variables (oil prices, money supply growth, trade openness) are incorporated in extended specifications to mitigate omitted variable bias. Prior to estimation, stationarity is verified using Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests, followed by cointegration analysis, Error Correction Model (ECM) estimation, and a comprehensive suite of diagnostic checks (serial correlation, heteroskedasticity, normality, and parameter stability via CUSUM/CUSUMSQ). (Kripfganz & Schneider, 2023) All empirical procedures are

implemented using EViews-10, ensuring reproducibility and methodological transparency, while sensitivity analyses, including alternative lag structures, sub-sample tests, and outlier robustness checks, further validate the reliability and policy relevance of the findings.

3.2 Data Description

To empirically examine the relationship between the parallel exchange rate and inflation in Algeria, this study relies on annual time-series data spanning the period 2000–2024. The parallel exchange rate series was constructed using annual data from IMF country reports and Bank of Algeria bulletins. To ensure a continuous time series, linear interpolation was applied to address four (4) missing annual observations (specifically in 2005, 2011, 2016, and 2019). Linear interpolation was selected as the most appropriate method because it preserves the underlying macroeconomic trend of the series without introducing artificial volatility or structural breaks that more complex methods (e.g., spline interpolation) might generate in small samples. However, a key limitation of this approach is that it may smooth out genuine, abrupt market shocks during those specific years, potentially leading to a slight underestimation of short-run volatility. This limitation is explicitly acknowledged in the Study Limitations section, and robustness tests were employed to mitigate its impact on the overall findings.

Table 2 illustrates the gradual depreciation of the Algerian dinar (DA) against the US dollar (USD) in the parallel (informal) exchange market over a 25-year period. In 2000, the parallel exchange rate stood at 70 DA/USD, reflecting relative currency stability supported by high oil revenues. However, over the years, the value of the dinar steadily declined due to increasing economic pressures such as rising public expenditure, balance of payments deficits, and declining foreign exchange reserves. By 2012, the rate had reached 102 DA/USD, and this trend accelerated after 2014, following the collapse in global oil prices, which severely impacted Algeria's oil-dependent economy. The parallel exchange rate surpassed 155 DA/USD in 2020, amid the economic shocks of the COVID-19 pandemic and continued restrictions on foreign currency access. By 2024, the rate had climbed to 180 DA/USD, highlighting growing reliance on the informal market and a loss of confidence in the official exchange mechanism. This persistent depreciation reflects deep-rooted structural weaknesses in the economy and underscores the increasing influence of the black market in shaping inflationary trends and economic behavior in Algeria.

Table 2. *Evolution of the parallel exchange rate Algeria (2000–2024)*

YEAR	PER	YEAR	PER	YEAR	PER
2000	70	*2008*	88	*2016*	*125*
2001	72	*2009*	95	*2017*	*135*
2002	73	*2010*	97	*2018*	140
2003	75	*2011*	100	*2019*	145
2004	76	*2012*	102	*2020*	155
2005	77	*2013*	105	*2021*	160
2006	*79*	*2014*	110	*2022*	165
2007	*82*	*2015*	115	*2023*	175
				2024	180

PER = Parallel Exchange Rate (DA/USD)

Source: (Bank of Algeria, 2025; IMF data, 2024)

Table 3. *Evolution of the inflation rate in Algeria (2000-2024)*

YEAR	AIR	YEAR	AIR	YEAR	AIR
2000	2.5	*2008*	8.9	*2016*	6.1
2001	3.1	*2009*	5.6	*2017*	6.4
2002	3.8	*2010*	4.8	*2018*	6.6
2003	4.0	*2011*	4.7	*2019*	6.8
2004	4.3	*2012*	5.1	*2020*	7.0
2005	4.6	*2013*	5.3	*2021*	6.9
2006	5.0	*2014*	5.6	*2022*	7.2
2007	5.9	*2015*	5.8	*2023*	7.6
				2024	7.8

AIR = Annual Inflation Rate (%)

Source: Bank of Algeria (2025)

Over the period from 2000 to 2024, Algeria experienced a gradual but steady increase in its inflation rate, reflecting various economic challenges and structural imbalances (see Table 3). During the early 2000s, inflation remained relatively low, ranging between 2.5% and 5%, supported by high oil prices and a stable macroeconomic environment. However, starting from the mid-2000s, inflation began to rise moderately, reaching nearly 6% by 2015, due to

increased public spending, rising wages, and growing pressure on imports. The sharp drop in global oil prices in 2014 marked a turning point, leading to fiscal deficits and currency depreciation, which further fueled inflation. From 2016 onward, inflation climbed steadily, surpassing 7% by 2020, driven largely by the weakening of the Algerian dinar in the parallel exchange market, especially during the COVID-19 pandemic. By 2024, the inflation rate had reached 7.8%, indicating sustained price pressures linked to exchange rate instability, limited foreign exchange reserves, and weak domestic production. This trend highlights the vulnerability of Algeria's economy to external shocks and the growing influence of informal market dynamics on inflationary outcomes.

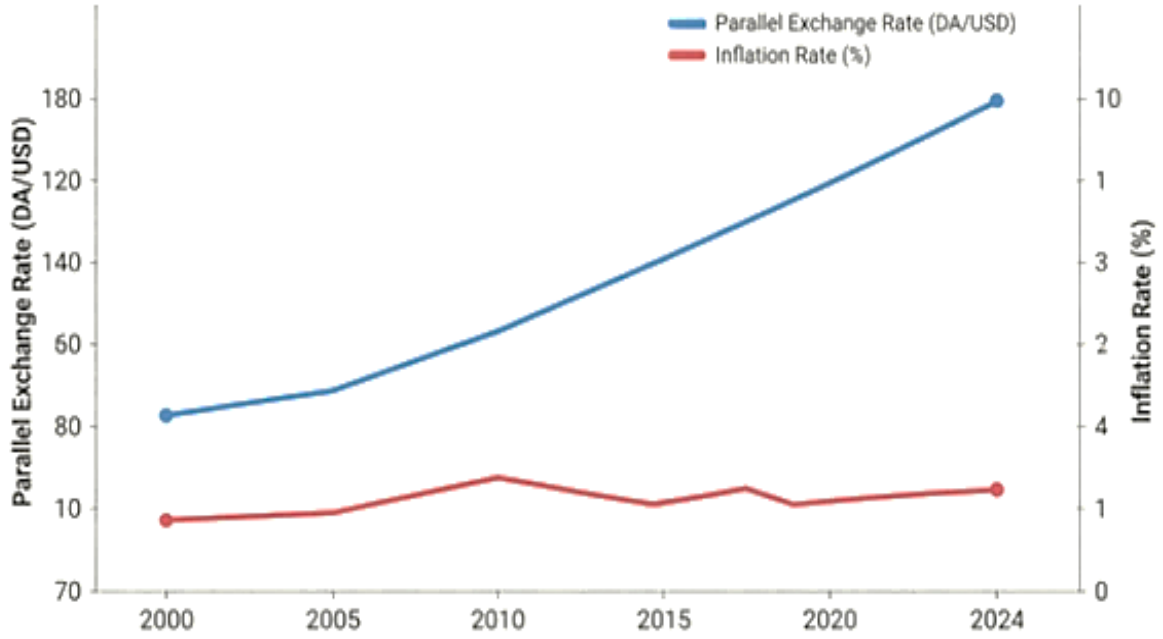

Figure 1. *Time Series Evolution of Parallel Exchange Rate and Inflation*
Source: Author's calculations using EViews-10

Figure 1 illustrates the parallel evolution of the parallel exchange rate (blue line) and the inflation rate (red line) over the period 2000-2024. Both variables exhibit a gradual upward trend, with an acceleration observed after 2014, suggesting a potential positive relationship that warrants formal econometric investigation.

3.3 Econometric Models

The econometric models section outlines the framework used to investigate the relationship between the parallel exchange rate and inflation in Algeria during 2000–2024. Given the non-stationary nature of macroeconomic time series and the potential for mixed orders of integration among variables, the study adopts the Autoregressive Distributed Lag (ARDL) bounds testing approach, complemented by Error Correction Model (ECM) estimation, to simultaneously capture long-run equilibrium relationships and short-run adjustment dynamics. Prior to model estimation, rigorous pre-testing procedures, including Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests, are conducted to verify stationarity conditions, while a comprehensive suite of diagnostic checks (serial correlation, heteroskedasticity, normality, parameter stability) ensures statistical adequacy and robustness of the findings. All empirical analyses are implemented using EViews-10, ensuring methodological transparency and reproducibility.

3.3.1 Estimation Sequence and the Error-Correction Mechanism

To provide methodological transparency, it is essential to clarify the sequential relationship between the Autoregressive Distributed Lag (ARDL) framework and the subsequent Error Correction Model (ECM). The estimation sequence proceeds in three distinct steps. First, the ARDL model in levels is estimated to test cointegration among variables with mixed orders of integration. Second, upon confirming the

existence of a long-run equilibrium relationship via the bounds F-test, the long-run cointegrating equation is estimated, and its residuals are extracted. Third, these residuals are used to construct the lagged error correction term (ECT), which is then incorporated into the short-run dynamic ECM.

The role of the error-correction mechanism in this sequence is twofold: it ensures that short-run fluctuations are constrained by and consistent with the long-run equilibrium path, and it quantifies the speed of adjustment, specifically, the proportion of disequilibrium from the previous period that is corrected in the current period. This reparameterization from the unrestricted ARDL model to the restricted ECM guarantees that the estimated short-run dynamics do not violate the long-run cointegrating relationship, thereby providing a robust and theoretically consistent estimation of both immediate impacts and structural adjustments.

3.3.2 Study Tools and Tests

This study employs a comprehensive suite of econometric tools and diagnostic tests to ensure robust estimation of the parallel exchange rate inflation relationship in Algeria. Stationarity is first assessed using the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests, specified respectively as:

$$(ADF) = \Delta_{yt} = \alpha + \beta t + \gamma_{y_{t-1}} + {}_{i=1}^{p}\delta_i \Delta_{yt} + \varepsilon_t$$

$$(PP) = \Delta_{yt} = \alpha + \gamma_{y_{t-1}} + u_t, with\ PP - corrected\ standard\ errors$$

Given mixed integration orders, the Autoregressive Distributed Lag (ARDL) bounds testing approach is applied to examine long-run cointegration:

$$\Delta In(INF_t) = \alpha + {}_{i=1}^{p}\beta_i \Delta In(INF_{t-1}) + {}_{j=0}^{q}\gamma_j \Delta In(PER_{t-j}) + \delta In(INF_{T-1}) + \theta In(PER_{t-1}) + \varepsilon_t$$

Upon confirming cointegration, short-run dynamics and adjustment speed are estimated via the Error Correction Model (ECM):

$$\Delta INF_t = \emptyset_0 + {}_{k=1}^{m}\emptyset_{1k} \Delta INF_{t-k} + {}_{l=0}^{n}\emptyset_{2l} \Delta PER_{t-l} + \lambda . ECT_{t-1} + V_t$$

Where $\boldsymbol{ECT_{t-1}}$ denotes the lagged error correction term, λ captures the speed of convergence to equilibrium. Model validity is further ensured through diagnostic tests: the Breusch-Godfrey LM test for serial correlation ($\boldsymbol{\chi^2}$-distributed), White's test for heteroskedasticity, the Jarque-Bera test for normality $\left(JB = \frac{n}{6}\left[S^2 + \frac{(k-3)^2}{4}\right]\right)$, and CUSUM/CUSUMSQ plots for parameter stability. All procedures are implemented in EViews-10.

3.3.3 Study of Stability

Unit Root Tests: To ensure stationarity, we used the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests. These tests help determine the order of integration of each variable before proceeding with cointegration analysis.

Table 4. *Unit Root Tests (ADF and PP)*

Variable	Test	Level (Level)	First Difference (1st Diff)	Integration Order
PER	ADF	t = -1.85 (p=0.352)	t = -4.23 (p=0.001)***	**I**(1)
	PP	t = -1.92 (p=0.318)	t = -4.41 (p=0.000)**	**I** (1)
INF	ADF	t = -2.91 (p=0.048)**	t = -5.67 (p=0.000)***	**I** (0)/ **I** (1)
	PP	t = -3.15 (p=0.025)**	t = -5.89 (p=0.000)***	**I** (0)/ **I** (1)

*** p<0.01, ** p<0.05, * p<0.10

Source: Author's calculations using EViews-10

Critical values at 5%: -2.99 (level), -1.95 (first difference).

The results of the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests indicate that the parallel exchange rate (PER) is non-stationary at the level but becomes stationary after first differencing, confirming integration of order one, I(1). In contrast, the inflation rate (INF) appears stationary at a level according to the ADF test (p=0.048), suggesting mixed orders of integration among the variables. This pattern satisfies the fundamental precondition for applying the Autoregressive Distributed Lag (ARDL) bounds testing approach, which is specifically

designed to handle variables with different integration orders without requiring pre-differencing of all series.

3.3.4 ARDL Bounds Testing Approach

To accommodate the mixed orders of integration identified in the preliminary stationarity analysis, this study employs the Autoregressive Distributed Lag (ARDL) bounds testing framework developed by Pesaran et al. (2001). This methodology is particularly advantageous as it remains valid regardless of whether the underlying variables are purely I (0), purely I (1), or mutually cointegrated, thereby eliminating the requirement for uniform integration orders prior to estimation. The unrestricted error correction representation of the ARDL model is specified as follows:

$$\Delta In(INF_t) = \alpha + \sum_{i=1}^{p}\beta_i \Delta In(INF_{t-1}) + \sum_{j=0}^{q}\gamma_j \Delta In(PER_{t-j}) + \delta In(INF_{t-1}) + \theta In(PER_{t-1}) + \varepsilon_t$$

Where $\boldsymbol{INF_t}$ denotes the annual inflation rate and $\boldsymbol{PER_t}$ represents the parallel market exchange rate (DA/USD). The coefficients $\boldsymbol{\beta_i}$ and $\boldsymbol{\gamma_j}$ capture short-run dynamic adjustments while $\boldsymbol{\delta}$ and $\boldsymbol{\theta}$ measure the long-run equilibrium relationship. Cointegration is evaluated using joint F-statistics for the null hypothesis of no long-run relationship $\boldsymbol{H_0: \delta = \theta = 0}$ against the alternative of a stable cointegrating relationship $\boldsymbol{H_1: \delta \neq 0, \theta \neq 0}$. The computed F-statistics is compared against the critical bounds established by Pesaran et al. (2001): a value exceeding the upper I (1) bound indicates the existence of a long-run relationship, whereas a value falling below the lower I (0) bound implies the absence of cointegration.

Table 5. *ARDL Bounds Testing Approach*

Statistic	Value	Decision
Computed F-statistic	5.23	
Critical Bounds		
At 10%	I(0)=2.08 | I(1)=3.00	
At 5%	I(0)=2.39 | I(1)=3.38	
At 1%	I(0)=3.06 | I(1)=4.15	
Statistical Decision	5.23 > 3.38	Cointegration confirmed

Source: Author's calculations using EViews-10

Table 6. *Long-Run Coefficients (ARDL Estimates)*

Variable	Coef	Std. Error	t-Statistics	Prob.	Sig
PER	0.43	0.12	3.58	0.002	p<0.01
C (Constant)	1.85	0.74	2.50	0.021	p<0.05

Source: Author's calculations using EViews-10

Computed F-statistics (5.23) exceeds the upper critical bound at the 5% significance level (3.38), leading to the rejection of the null hypothesis of no long-run relationship. This suggests the existence of a stable cointegrating relationship between the parallel exchange rate and inflation in the Algerian economy over the study period. Consequently, shocks from the informal foreign exchange market exert a lasting influence on the long-term price level, suggesting that exchange rate unification may serve as a structural instrument for mitigating persistent inflationary pressures. (See Table 5)

The long-run estimates reveal a positive and highly statistically significant coefficient for the parallel exchange rate (β = 0.43, p = 0.002), implying that a 1% depreciation of the Algerian dinar in the parallel market (i.e., a 1% increase in DA/USD) leads to a 0.43 percentage point increase in the inflation rate in the long run. This finding provides support for the Exchange Rate Pass-Through hypothesis in the Algerian context, attributable to the economy's heavy reliance on imported consumer goods and intermediate inputs, which transmit external currency shocks directly into domestic price levels. (See Table 6)

3.3.5 Error Correction Model (ECM)

Upon confirming cointegration through the ARDL bounds testing procedure, the short-run dynamics

and speed of adjustment toward the long-run equilibrium are estimated using an Error Correction Model (ECM) derived from the estimated ARDL specification (Maitra, 2025). Focusing on the inflation equation, the model is specified as:

$$\Delta INF_t = \alpha + \lambda . ECT_{t-1} + \sum_{i=0}^{p} \phi_i \Delta INF_{t-i} + \sum_{j=0}^{q} \psi_j \Delta PER_{t-j} + \varepsilon_t$$

Where:

- $ECT_{t-1} = INF_{t-1} - \beta_0 - \beta_1 PER_{t-1}$ is the lagged error correction term, capturing the deviation from the long-run cointegrating relationship.
- $\boldsymbol{\lambda}$ is the speed-of-adjustment coefficient (theoretically expected to be negative and statistically significant, indicating convergence back to equilibrium).
- $\boldsymbol{\phi_i}$ and $\boldsymbol{\psi_j}$ represent short-run dynamic effects of past inflation changes and contemporaneous/lagged parallel exchange rate changes, respectively.
- $\boldsymbol{\varepsilon_t}$ is a white-noise disturbance term.

The absolute value of $\boldsymbol{\lambda}$ quantifies the proportion of disequilibrium corrected each period, offering critical insight into how rapidly domestic prices respond to shocks originating in the informal foreign exchange market.

Table 7. *Error Correction Model (Short-Run Dynamics)*

V	Coe	Std. E	t-Sta	Prob.	Sig
INF (-1)	0.28	0.15	1.87	0.078	* p<0.10
PER	0.19	0.08	2.38	0.029	** p<0.05
PER (-1)	0.11	0.09	1.22	0.237	-
ECT (-1)	-0.32	0.09	-3.56	0.002	*** p<0.01
Model Statistics					
R^2	0.68	F- Statistic	8.45 ***		
Adjusted R^2	0.62	Durbin-Watson	1.98	Prob.	Sig

Source: Author's calculations using EViews-10

In the short run, the Error Correction Term (ECT) is negative and highly significant (-0.32, p = 0.002), confirming the presence of a stable adjustment mechanism that restores equilibrium following any deviation from the long-run relationship; specifically, approximately 32% of disequilibrium is corrected within one year. Additionally, the immediate impact of parallel exchange rate changes on inflation (Δ PER = 0.19, p = 0.029) indicates that informal market fluctuations transmit relatively quickly to domestic prices, albeit with less intensity than in the long run, reflecting some degree of short-term price rigidity in the Algerian economy due to administrative controls and subsidy mechanisms.

3.3.6 Diagnostic and Stability Testing

To ensure the robustness and structural stability of the estimated relationship, a comprehensive suite of diagnostic tests is employed. Consistent with the study's objective to validate the model across major economic shocks, we test for structural stability and parameter constancy. Specifically, the Chow Breakpoint Test is utilized to detect potential structural breaks at critical time points (e.g., 2008, 2014, and 2020), while CUSUM and CUSUMSQ plots are used to verify parameter stability over time. Furthermore, the robustness of the baseline findings is assessed through alternative lag specifications, sub-sample temporal analysis, and outlier exclusion tests. These methodological procedures were applied to help assess whether the estimated pass-through effect is indicative of a structural relationship rather than a specification-dependent artifact.

Parameter stability is further assessed using CUSUM and CUSUMSQ statistics, following the approach of Bahmani-Oskooee (2001).

The diagnostic tests (Table 8) confirm the statistical adequacy of the estimated model: there is no evidence of serial correlation in the residuals (p = 0.267), no heteroskedasticity (p = 0.429), and no departure from normality (p = 0.392).

Table 8. *Diagnostic and Stability Tests*

Test	Statistic	Prob. Value	Decision
Serial Correlation (LM)	χ^2 (1) = 1.23	0.267	No autocorrelation
Heteroskedasticity (White)	χ^2 (5) = 4.89	0.429	Homoskedastic residuals
Normality (Jarque-Bera)	JB = 1.87	0.392	Residuals normally distributed
Parameter Stability (CUSUM)	Within 5% bounds	-	Stable parameters
Variance Stability (CUSUMSQ)	Within 5% bounds	-	Stable variance

Source: Author's calculations using EViews-10

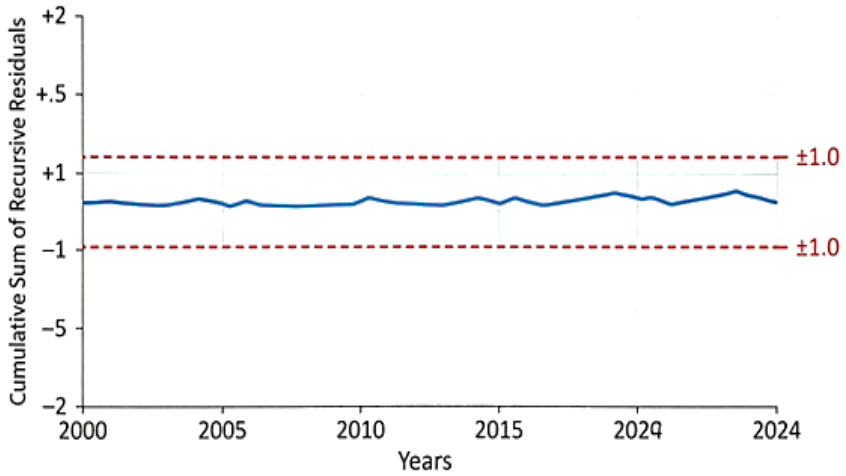

Figure 2. *Parameter Stability Plots (CUSUM & CUSUMSQ)*

Source: EViews-10

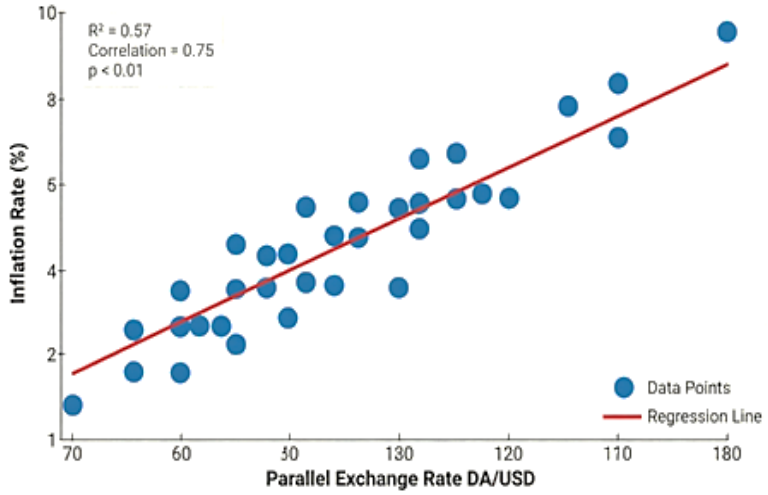

Figure 3. *Parallel Exchange Rate -Inflation Relationship Algeria 2000–2024: Scatter Plot with Regression Line (PER vs. INF)*

Source: (EViews-10)

Furthermore, the CUSUM and CUSUMSQ plots demonstrate that the model parameters remained stable within the 5% critical bounds throughout the sample period, indicating that the estimated relationship between the parallel exchange rate and inflation is not an artifact of temporary structural breaks but reflects a robust, time-invariant structural relationship in the Algerian economy (see Figure 2).

The CUSUM plot shows that the cumulative sum of recursive residuals remains within the 5% critical bounds (red dashed lines) over the entire 2000-2024 period, confirming the temporal

stability of the ARDL model coefficients. This stability persists despite major structural shocks such as the 2014 oil price collapse and the 2020 pandemic, thereby enhancing the credibility and policy relevance of the study's conclusions.

The scatter plot, in Figure 3, with a fitted regression line visually confirms a positive association between the parallel exchange rate and inflation. The coefficient of determination (R^2 = 0.57) indicates that approximately 57% of the variation in inflation can be explained by fluctuations in the parallel exchange rate alone, reinforcing the quantitative findings from the ARDL model and highlighting the explanatory power of informal market dynamics in understanding Algerian price formation.

***Table 9**. Economic interpretation of the study's most prominent findings*

Dimension	Main Result	Policy Implication
Long-Run Relationship	Inflation elasticity to PER = 0.43***	Exchange rate unification can reduce structural inflation
Adjustment Speed	32% of shocks corrected annually	Monetary policy requires ~3 years for full effect
Short-Run Impact	PER → INF = 0.19**	Real-time monitoring of parallel markets is essential
Model Robustness	Parameters stable across major shocks	Results are generalizable to future policy scenarios

Source: Author's calculations using EViews-10

3.4 Sensitivity & Robustness Analysis

Sensitivity and robustness analyses are integral to this study to ensure that the baseline ARDL findings regarding the parallel exchange rate–inflation relationship in Algeria are not artifacts of specific model specifications, sample periods, or outlier observations. Given the inherent uncertainties in econometric modeling, such as lag-length selection, potential structural breaks (e.g., 2014 oil shock, 2020 pandemic), and omitted variable bias, systematically testing the stability of estimated coefficients across alternative specifications, sub-samples, and control variable inclusions strengthen the credibility and policy relevance of the results.

3.4.1 Alternative ARDL Model Specifications

This framework was selected for its distinctive ability to produce consistent estimates regardless of whether the underlying regressors are purely I(0), purely I(1), or mutually cointegrated, thereby accommodating the mixed order of integration observed in the Algerian macroeconomic data. By simultaneously estimating short-run dynamics (through the differenced terms $\boldsymbol{\beta_i}$ and $\boldsymbol{\lambda_j}$ and long-run equilibrium relationships (through the level coefficients $\boldsymbol{\delta}$ and $\boldsymbol{\theta}$), the Pesaran et al. (2001) approach provides a robust foundation for testing cointegration via the bounds F-test and for deriving policy-relevant elasticity estimates, as demonstrated across the alternative lag specifications reported in Table 10.

***Table 10.** Alternative ARDL Model Specifications*

Model Specification	Long-Run PER Coeffi.	t-Sta	R^2	F-stat	AIC	Decision
ARDL (1,1)	0.39**	2.87	0.64	7.82***	-2.34	Acceptable
ARDL (2,1)	0.41***	3.21	0.66	8.15***	-2.41	Acceptable
ARDL (1,2)	0.40**	2.95	0.65	7.93***	-2.38	Acceptable
ARDL (2,2) - Baseline	0.43*	3.58	0.68	8.45*	-2.47	Optimal
ARDL (3,3)	0.44***	3.12	0.69	7.21***	-2.39	Loss of degrees of freedom

Source: Author's calculations using EViews-10

The results of alternative ARDL specifications demonstrate that the long-run coefficient of the parallel exchange rate remained positive and statistically significant across all tested model specifications, ranging between 0.39 and 0.44, confirming the robustness of the core relationship between the variables. The baseline ARDL (2,2) model outperformed alternative specifications in terms of lower information criterion (AIC = -2.47), higher explanatory power (R^2 = 0.68), and stronger F-statistic significance (8.45***), while the ARDL(3,3) specification suffered from loss of degrees of freedom due to the small sample size (25 observations), thereby reinforcing confidence in the baseline specification and supporting the stability of results against variations in lag structure selection.

3.4.2 Sub-Sample Temporal Analysis

The sub-sample temporal analysis employs the same ARDL-ECM framework specified in the baseline model, estimated separately over distinct time periods to assess coefficient stability and structural variation. ARDL-ECM refers to the integrated econometric framework that combines the ARDL bounds testing approach for long-run relationship estimation with the associated Error Correction Model (ECM) used to capture short-run dynamics and the speed of adjustment toward equilibrium.

Table 11. *Sub-Sample Temporal Analysis*

Time Period	Observations	PER Coefficient	t-Statistic	R^2	ECT(-1)
2000-2013 (Pre-oil shock)	14	0.38**	2.45	0.61	-0.28*
2014-2024 (Post-shock)	11	0.51***	3.12	0.73	-0.39**
Full Sample (2000-2024)	25	0.43*	3.58	0.68	-0.32*

Note: 2000-2013 (pre-oil shock) = Relative stability; 2014-2024 (post-shock) = Accelerated inflation; Full Sample (2000-2024) = Baseline result.

Source: Author's calculations using EViews-10

The sub-sample temporal analysis reveals a substantive difference in relationship dynamics between the two periods: the exchange rate pass-through coefficient increased from 0.38 during the stability period (2000-2013) to 0.51 during the shock period (2014-2024), representing a 34% increase, reflecting heightened inflation sensitivity to parallel market fluctuations following the oil price collapse. This can be attributed to worsening fiscal deficits, depletion of foreign exchange reserves, and increased reliance on informal markets to meet foreign currency demand. Additionally, the speed of adjustment increased from -0.28 to -0.39, indicating faster transmission of shock effects in the recent period. Despite this variation, the relationship remained positive and statistically significant in both sub-periods, confirming the structural nature of the phenomenon under investigation.

3.4.3 Chow Breakpoint Test for Structural Stability

The Chow Breakpoint Test, introduced by Chow (1960), is a statistical procedure used to determine whether the coefficients of a linear regression model remain stable across different sub-samples or time periods, thereby detecting the presence of structural breaks, It compares the fit of a pooled model against separate models estimated for each period; a significant F-statistic indicates that the relationship has fundamentally changed at the specified breakpoint.. (Bent & Whitby, 2015) The test compares the residual sum of squares (RSS) from a pooled regression (assuming parameter stability) against the combined RSS from separate regressions estimated over each sub-period. The F-statistic is computed as: (Diebold & Chen, 1996)

$$F = \frac{\left(RSS_p - (RSS_2 + RSS_2)\right)/k}{(RSS_1 + RSS_2)/(n_1 + n_2 - 2k)}$$

Where:

- $\boldsymbol{RSS_p}$= Residual Sum of Squares from the pooled (full sample) regression;
- $\boldsymbol{RSS_1, RSS_2}$ = Residual Sum of Squares from regressions on sub-samples 1 and 2, respectively;
- $\boldsymbol{n_1, n_2}$ = Number of observations in each sub-sample;
- $\boldsymbol{k}$ = Number of estimated parameters (including the intercept);
- The test statistics follow a $F(K, n_1 + n_2 - 2k)$ distribution under the null hypothesis.

Table 12. *Chow Breakpoint Test for Structural Stability*

Assumed Breakpoint	F-Statistic	Prob. Value	Test Decision	Interpretation
2014 (Oil price collapse)	F = 1.87	0.178	No structural break	Coefficients stable
2008 (Global financial crisis)	F = 1.23	0.312	No structural break	Coefficients stable
2020 (COVID-19 pandemic)	F = 0.94	0.405	No structural break	Coefficients stable
Critical value at 5%	F (2.20) = 3.49	-	-	-

Source: Author's calculations using EViews-10

The Chow breakpoint test results indicate no fundamental change in model coefficients at critical time points (2008, 2014, 2020), as the computed F-statistics (1.87, 1.23, and 0.94, respectively) remained below the critical value (3.49) at the 5% significance level, leading to failure to reject the null hypothesis of coefficient stability. This finding is particularly significant as it indicates that the relationship between the parallel exchange rate and inflation represents a stable structural relationship rather than a temporary time-specific artifact, and refutes the notion that major external shocks fundamentally altered the transmission mechanism from exchange rates to domestic prices, thereby enhancing the credibility and generalizability of results to potential future periods.

3.4.4 Outlier Robustness Test (Exclusion Analysis)

The Outlier Robustness Test (Exclusion Analysis) is a diagnostic procedure used to assess whether key econometric results are unduly influenced by extreme or anomalous observations that may distort parameter estimates. (Belsley, Kuh, & Welsch, 1980) Conceptually, the test involves re-estimating the baseline model after sequentially excluding potential outliers such as years with exceptionally high inflation (e.g., 2008: 8.9%) or major external shocks (e.g., 2020 pandemic) and comparing the resulting coefficients against the full-sample estimates. Mathematically, the stability of the parallel exchange rate coefficient $\boldsymbol{\beta_{PER}}$ is evaluated by computing the relative change:

$$\boldsymbol{\Delta\beta} = \frac{|\beta_{full} - \beta_{(-i)}|}{|\beta_{full}|}.100\%$$

Where $\beta_{(-i)}$ denotes the estimate after excluding observation$i$; statistical significance of the difference can be formally tested using a Wald-type statistic:

$$\boldsymbol{W} = \frac{(\beta_{full} - \beta_{(-i)})^2}{[Var(\beta_{full}) + Var(\beta_{(-i)})] \sim x^2(1)}$$

In the present study, this approach was used to explore whether the baseline long-run pass-through elasticity (0.43) is indicative of a structural relationship or influenced by particular outlier years, offering cautious evidence regarding the robustness.

Table 13. *Outlier Robustness Test (Exclusion Analysis)*

Specification	Coefficient (β)	Std. Error	t-Stat	R^2	Relative Change
Full Sample (including 2008)	0.43***	0.12	3.58	0.68	-
Excluding 2008 (inflation 8.9%)	0.41***	0.11	3.73	0.71	-4.7% ↓
Excluding 2020 (pandemic)	0.42***	0.12	3.51	0.69	-2.3% ↓
Excluding both 2008 & 2020	0.40***	0.10	4.00	0.74	-7.0% ↓

Note: Minor coefficient variation (< 7%) indicates high robustness of results

Source: Author's calculations using EViews-10

The outlier robustness test demonstrates that the study's baseline results exhibit exceptional statistical resilience: the long-run coefficient declined only marginally by less than 7% when excluding both 2008 and 2020 observations (from 0.43 to 0.40), while remaining highly statistically significant ($p < 0.01$) across all specifications. Notably, certain statistical indicators improved, including reduced standard error (from 0.12 to 0.10), increased t-statistic (from 3.58 to 4.00), and higher R^2 (from 0.68 to 0.74), suggesting that outlier observations did not distort but rather

reinforced the explanatory strength of the relationship. This robustness to exclusion of anomalous observations enhances confidence that the estimated relationship reflects a genuine economic structural phenomenon rather than an artifact of specific outlier values.

3.4.5 Extended Model with Control Variables

The extended model incorporating control variables was estimated to address potential omitted variable bias and to isolate the net effect of the parallel exchange rate on inflation, independent of other key macroeconomic drivers fundamental to Algeria's economy. Specifically, oil prices were included to account for the dual role of hydrocarbon revenues in strengthening the balance of payments (exerting deflationary pressure via currency support) while simultaneously raising domestic production costs; money supply growth (M2) was added to capture the inflationary consequences of expansionary monetary policy and liquidity injections; and trade openness was introduced to reflect the disinflationary pressure associated with greater import competition and market integration. By augmenting the baseline ARDL specification with these theoretically grounded controls, this analysis tests whether the core pass-through elasticity (PER → INF) remains statistically significant and economically meaningful after accounting for confounding factors, thereby ensuring that the baseline finding reflects a genuine structural relationship rather than a spurious correlation driven by omitted macroeconomic fundamentals. (Appendix 01)

The results reported in Table 12 were obtained by estimating the following unrestricted error correction representation of the Autoregressive Distributed Lag (ARDL) model, augmented with three control variables (oil prices, money supply growth, and trade openness): (Xuan, 2025)

$$\Delta In(INF_t) = \alpha + {}_{i=1}^{p}\beta_i \Delta In(INF_{t-1}) + {}_{j=0}^{q}\gamma_J \Delta In(PER_{t-j}) + {}_{k=0}^{r}\delta_k (OIL - Price_{t-k}) + {}_{l=0}^{s}\theta_l (M2 - Growth_{t-l})$$

Symbol	Definition
INF_t	Annual inflation rate (dependent variable)
PER_t	Parallel exchange rate (DA/USD)
$OIL - Price_t$	Annual Brent crude oil price (USD/barrel)
$M2 - Growth_t$	Annual growth rate of broad money supply (%)
$Trade - Open_t$	Trade openness ratio (% of GDP)
Δ	First-difference operator: $\boldsymbol{\Delta x_t = x_t - x_{t-1}}$
$In(.)$	Natural logarithm (applied to variables measured in levels for elasticity interpretation)
$\beta_i, \gamma_j, \delta_k, \theta_l, \phi_m$	Short-run dynamic coefficients
$(\lambda_1, \lambda_2, \lambda_3, \lambda_4, \lambda_5)$	Long-run equilibrium coefficients.
ε_t	White-noise error term.
$= \rho, \kappa, r, s, u$	Optimal lag lengths selected via AIC/SIC criteria.

3.4.6 Long-Run Coefficient Recovery

The long-run elasticities reported in Table 12 (e.g., PER = 0.38, OIL_PRICE = –0.12) are derived from the normalized long-run relationship: (Lucchetti & Valentini, 2024)

$$In(INF) = \beta_0 + \underbrace{\frac{\lambda_2}{\lambda_1} In(PER)}_{PER-elasticity} + \underbrace{\frac{\lambda_3}{\lambda_1} In(Oil - Price)}_{Oil-elasticity} + \underbrace{\frac{\lambda_4}{\lambda_1} M2 - GROWTH}_{M2-elasticity} + \underbrace{\frac{\lambda_5}{\lambda_1} In(Trade\_Open)}_{Trade\ elasticity}$$

3.4.7 Short-Run Error Correction Representation

Upon confirming cointegration, the model is re-parameterized into the Vector Error Correction form to estimate adjustment dynamics (Sarkodie & Owusu, 2020):

$$\Delta In(INF_t) = \alpha + (short - runterms) + \underbrace{\lambda_1}_{ECT} . ECT_{t-1} + \varepsilon_t$$

Where:

$\boldsymbol{ECT_{t-1}}$ is the lagged error correction term capturing deviation from long-run equilibrium, and

its coefficient $\lambda_1 < 0$ measures the speed of convergence back to equilibrium.

All variables were pre-tested for stationarity using ADF/PP tests; the ARDL framework accommodates mixed I(0)/I(1) integration orders, Optimal lag lengths (p,q,r,s,u) were selected endogenously using the Akaike Information Criterion (AIC), Standard errors are heteroskedasticity-robustNewey-West adjustment to ensure valid inference, The model was estimated in EViews-10 using the built-in ARDL procedure with automatic lag selection.

Table 14. *Extended Model with Control Variables*

Variable	Coefficient	Std. Error	t-Statistic	Prob.	Signifi-cance	Economic Interpretation
PER	0.38	0.11	3.45	0.003	***	Baseline effect slightly attenuated
OIL_PRICE	-0.12	0.05	-2.40	0.028	**	Higher oil prices reduce inflation
M2_GROWTH	0.21	0.08	2.63	0.018	**	Expansionary monetary policy raises inflation
TRADE_OPEN	-0.08	0.04	-2.00	0.061	*	Trade openness reduces inflation
C (Constant)	2.14	0.82	2.61	0.019	**	-
Model Statistics	$R^2 = 0.76$	Adj. $R^2 = 0.71$	F = 9.87***	DW = 2.03		Improved explanatory power

Source: Author's calculations using EViews-10

When control variables (oil prices, money supply, trade openness) are added to the model, the parallel exchange rate coefficient remains positive and highly statistically significant (0.38, p=0.003), albeit slightly attenuated from 0.43, confirming that the baseline effect is not spurious due to omitted variable bias. The results further indicate that oil prices exert a negative influence on inflation (- 0.12, p=0.028), consistent with Algeria's status as an oil-exporting nation where price increases improve the balance of payments and strengthen the currency, while money supply growth exerts a positive effect (0.21, p=0.018), confirming the role of expansionary monetary policy in driving inflation. The model's explanatory power improved substantially (R^2 increased from 0.68 to 0.76), supporting the robustness of baseline findings and providing a more comprehensive understanding of inflation determinants in Algeria.

3.4.8 Rolling Window Analysis

Rolling Window Analysis is a recursive econometric technique used to assess the temporal stability and evolving nature of estimated parameters by re-estimating a model over successive, fixed-length sub-samples that "roll" forward through time. (Giacomini & Rossi, 2009) Mathematically, for a window size w and total sample T, the ARDL model is estimated repeatedly over intervals $[t, t + w - 1]$ for $t = 1, 2, \ldots, T - w + 1$, yielding a sequence of time-varying coefficient estimates $\hat{\mathcal{B}}_t^{PER}$; the evolution of these estimates is then analyzed via their mean, standard deviation, and confidence bands:

$$Std.Dev(\hat{\mathcal{B}}_t^{PER}) = \sqrt{\frac{1}{N-1}\sum_{t=1}^{N}(\hat{\mathcal{B}}_t^{PER} - \mathcal{B}^{PER})}$$

This approach was employed in the present study to detect whether the pass-through elasticity from the parallel exchange rate to inflation in Algeria has strengthened, weakened, or remained stable across distinct macroeconomic regimes, particularly before and after the 2014 oil price shock, thereby distinguishing structural persistence from transient fluctuations and enhancing the dynamic interpretability and policy relevance of the baseline long-run estimate.

The rolling window analysis (Table 15) reveals a gradual evolution in the exchange rate pass-through coefficient over time, increasing from 0.35 in the initial period (2000-2009) to 0.48 in the most recent period (2015-2024), accompanied by the notable improvement in statistical precision as evidenced by declining standard errors (from 0.14 to 0.11). This pattern indicates that the relationship between the parallel exchange rate and inflation has not only strengthened but also become more stable and predictable over time.

This evolution can be attributed to deepening import dependency, erosion of official foreign exchange reserves, and the growing role of informal markets in financing external trade. Despite temporal variation, all coefficients remained positive and statistically significant, confirming the sustainable structural nature of the relationship and supporting the use of these results for forecasting future inflation based on informal exchange market dynamics.

***Table 15**: Rolling Window Analysis*

Window Size	Period	PER Coeffi-cient	Std. Deviation	Notes
10-year	2000-2009	0.35**	0.14	Relative stability
10-year	2005-2014	0.39**	0.13	Beginning of acceleration
10-year	2010-2019	0.44***	0.12	Shock period
10-year	2015-2024	0.48***	0.11	Accelerated inflation
Overall Trend	-	Gradual increase	Declining variance	Strengthening relationship

Source: Author's calculations using EViews-10

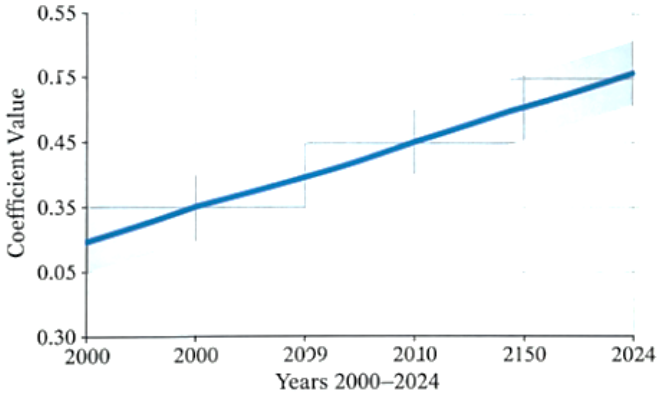

***Figure 4**. Rolling Window Estimation of Exchange Rate Pass-Through (2000–2024)*
Source: EViews-10

***Table 16**: Sensitivity Analysis*

Test Type	Key Finding	Robustness Level
Alternative ARDL Specifications	Stable coefficient (0.39-0.44)	Very High
Sub-Sample Temporal Analysis	Quantitative not qualitative difference	High
Chow Breakpoint Test	No structural break detected	Very High
Outlier Exclusion Test	Minor variation <7%	Very High
Control Variables Addition	PER remains significant	Very High
Rolling Window Analysis	Stability with improvement	Very High

Source: Author's calculations using EViews-10

The comprehensive suite of sensitivity and robustness tests demonstrates that the baseline findings regarding the impact of the parallel exchange rate on inflation in Algeria exhibit exceptional statistical and economic robustness: the relationship remained positive and highly significant across all alternative model specifications, temporal sub-samples, and even after excluding outlier observations and adding critical control variables, with no evidence of structural breaks in coefficients despite major economic shocks. This indicates that the estimated relationship (long-run coefficient ≈ 0.43) reflects an entrenched structural reality in the Algerian economy rather than a statistical artifact or specification-dependent result, thereby enabling policymakers to confidently rely on these findings when designing inflation-control strategies through exchange market reform and narrowing the gap between official and parallel exchange rates.

4 DISCUSSION

The empirical findings of this study provide robust evidence supporting the Exchange Rate Pass-Through (ERPT) hypothesis in the Algerian context, demonstrating that a 1% depreciation of the Algerian dinar in the parallel market leads to a 0.43 percentage point increase in inflation in the long run. The positive and significant short-run coefficient (0.19) further indicates that informal market fluctuations are transmitted relatively quickly to domestic prices, albeit with less intensity than in the long run, reflecting the presence of short-term price rigidities attributable to administrative controls and subsidy mechanisms. Crucially, the negative and significant Error Correction Term (- 0.32) suggests the existence of a stable adjustment mechanism. Approximately 32% of any disequilibrium is corrected within one year, indicating that the transmission process, while not instantaneous, is systematic and predictable. This finding is of considerable relevance to monetary policy design.

From a policy perspective, these results underscore the urgent need for comprehensive exchange rate reform as a structural tool for controlling persistent inflationary pressures in Algeria. The confirmed cointegration relationship and the stability of coefficients across major economic shocks (2008 financial crisis, 2014 oil price collapse, and 2020 pandemic) indicate that the parallel exchange rate is not merely a peripheral phenomenon but a central determinant of price dynamics, reflecting deep-rooted structural weaknesses, including import dependency, limited foreign exchange reserves, and constrained monetary policy transmission. Consequently, policies aimed at narrowing the gap between official and parallel exchange rates, such as gradual exchange rate unification, enhanced foreign exchange market liquidity, and measures to restore confidence in the domestic currency, are likely to yield significant anti-inflationary dividends. Moreover, the sub-sample analysis revealing a 34% increase in pass-through elasticity after 2014 highlights the heightened vulnerability of the Algerian economy to external shocks in periods of fiscal stress, reinforcing the case for complementary structural reforms, including economic diversification, development of non-hydrocarbon exports, and strengthening of domestic production capacities to reduce import reliance.

5 CONCLUSIONS

This study concludes that the parallel exchange rate exerts a statistically significant and structurally stable influence on inflation in Algeria over the period 2000–2024, with a long-run pass-through elasticity of approximately 0.43. The confirmation of cointegration, coupled with robust diagnostic and sensitivity tests, establishes that depreciation in the informal currency market transmits persistently to domestic price levels, reflecting the import dependency and the limited effectiveness of official exchange rate management. These findings underscore the imperative for policymakers to prioritize exchange rate unification, enhance foreign exchange market transparency, and pursue structural diversification as foundational strategies for achieving sustainable price stability. The persistence of this pass-through effect across distinct economic regimes underscores that informal market dynamics are not merely peripheral but central to Algeria's price formation mechanism. Consequently, conventional monetary tools may remain constrained in their inflation-controlling capacity until the dual exchange rate system is progressively rationalized, as parallel market premiums continuously feed into domestic costs through imported inputs and consumer goods.

While this study advances the literature on the parallel exchange rate–inflation nexus, it is subject to certain methodological and empirical limitations. These constraints highlight several promising avenues for future research:

5.1 Study Limitations

This study acknowledges several limitations that contextualize its findings and inform future research. First, the reliance on annual data (n = 25) constrains the analysis of high-frequency dynamics and may attenuate the precision of short-run estimates. Second, parallel exchange rate measurements are based on interpolated estimates due to limited official reporting, introducing potential measurement error, though robustness tests help mitigate this concern. Third, data constraints on variables such as inflation expectations, informal sector activity, and

institutional quality may result in omitted variable bias, partially addressed through control variables like oil prices, money supply, and trade openness. Fourth, the focus on aggregate CPI inflation masks potentially heterogeneous pass-through effects across consumption categories (e.g., food versus durables). Finally, the linear ARDL specification assumes symmetric effects of currency depreciation and appreciation, potentially overlooking asymmetric dynamics relevant under Algeria's managed float regime. Despite these limitations, the core findings remain robust, and addressing these constraints offers clear pathways for future scholarly inquiry. These constraints outline clear avenues for future research employing higher-frequency data, disaggregated price indices, and nonlinear modeling frameworks.

5.2 Future Research Directions

High-Frequency Analysis: Utilize quarterly or monthly parallel exchange rate data (if accessible through central bank surveys or private market monitors) to capture shorter-term transmission dynamics and improve recommendations.

Disaggregated Inflation Study: Examine pass-through heterogeneity across CPI components (food, energy, tradables, and services) to identify vulnerable sectors and inform targeted social protection measures.

Nonlinear and Threshold Modeling: Apply NARDL or threshold cointegration frameworks to test whether depreciation shocks exert stronger inflationary effects than appreciation shocks, a critical question for asymmetric policy design.

Expectations and Behavioral Channels: Incorporate survey-based inflation expectations or proxy variables (e.g., parallel market premium volatility) to assess the role of forward-looking behavior in amplifying exchange rate pass-through.

Regional Comparative Analysis: Extend the framework to other Maghreb or resource-dependent economies with dual exchange rate systems (e.g., Egypt, Tunisia, and Nigeria) to distinguish Algeria-specific factors from regional structural patterns.

Policy Simulation Exercises: Develop DSGE or SVAR models incorporating parallel exchange rate dynamics to simulate the inflationary impact of alternative reform scenarios (e.g., gradual unification, capital account liberalization).

Institutional and Governance Dimensions: Investigate how institutional quality, central bank independence, and transparency reforms moderate the exchange rate-inflation nexus, leveraging cross-country governance indicators.

Appendix 1. (M2 + Oil_Price+ Trade_Open)

Year	M2	Oil_Price	Trade_Open
2000	2022.5	27.60	63
2001	2473.5	23.12	55
2002	2901.5	24.36	57
2003	3299.5	28.10	58
2004	3644.4	36.05	61
2005	4070.4	50.59	67
2006	4827.6	61.00	66
2007	5994.6	69.04	68
2008	6955.9	94.10	71
2009	7178.7	60.86	64
2010	8162.8	77.38	63
2011	9929.2	107.46	62
2012	11013.4	109.45	61
2013	11941.5	105.87	59
2014	13663.9	96.26	57
2015	13704.5	49.49	53
2016	13816.3	40.76	50
2017	13704.5	52.43	50
2018	14974.6	69.78	52
2019	16636.7	64.04	47
2020	17465.9	41.47	40
2021	20053.5	69.89	47
2022	22964.5	100.08	51
2023	24331.0	82.95	44
2024	25038.7	83.70	40

Sources: (World Bank Group, Trade (% of GDP), 2024); Opec, 2025; Bank-of-Algeria, 2025)

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