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EXCHANGE RATE PASS-THROUGH AND INFLATION DYNAMICS IN ALGERIA: A VECTOR AUTOREGRESSION ANALYSIS OF SHORT- AND LONG-TERM EFFECTS

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ABSTRACT

This study investigates the bidirectional and time-varying interplay between exchange-rate movements and inflation in Algeria from 1990 to 2023. Employing a Vector Autoregression (VAR) framework on quarterly time-series data, it quantifies how exchange-rate shocks transmit into price levels and, conversely, how unexpected inflationary episodes feed back into currency valuation. The analysis also controls for key external and policy-related drivers—namely, global oil prices and domestic monetary-policy interventions—to isolate each variable's independent effects.

Empirical findings reveal a significant, though transitory, pass-through mechanism: a depreciation of the Algerian dinar leads to a marked uptick in inflation over subsequent quarters, while positive inflation shocks exert downward pressure on the dinar's real exchange rate. However, long-run causality between the two series remains inconclusive, suggesting that neither variable unilaterally dictates the other over extended horizons.

Based on these insights, the study recommends adopting an explicit inflation-targeting regime, deepening and liberalizing the foreign-exchange market, and enhancing policy transparency. It further advocates diversifying government revenues and strengthening the investment climate, alongside continuous monitoring of macroeconomic indicators to support timely policy adjustments.

KEYWORDS

Exchange Rate Fluctuations, Inflation Rates, Economic Stability, Purchasing Power, Monetary Policies

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1. Introduction

In today's highly integrated global economy, exchange rates underpin international trade and investment flows, directly influencing national growth trajectories. By reflecting the relative value of one currency against another, exchange rates shape import and export prices, guide foreign-investment decisions, and inform central-bank policy. A clear grasp of exchange-rate determination and cross-border economic linkages is therefore vital for sound policymaking, helping to secure financial stability, balance of payments equilibrium, and sustainable development.

Among the key macroeconomic indicators, inflation and exchange rates exhibit a close, bidirectional relationship. Currency depreciation raises the cost of imported inputs, fueling higher consumer prices, while surges in domestic inflation often trigger increased demand for foreign currency, exerting downward pressure on the local exchange rate (Benadda & Benslimane, 2018).

In Algeria—an economy heavily dependent on hydrocarbon revenues—ongoing efforts to contain inflation are challenged by volatile oil and gas export earnings, rigid fiscal frameworks, and external geopolitical shocks. These factors not only push up import costs but also complicate monetary-policy responses. Effective stabilization thus requires policy measures that enhance economic diversification, boost productivity, and strengthen infrastructure, alongside transparent and flexible exchange-rate management (Merieme & Nouria, 2018).

1.1. Research Problem

In an economy heavily dependent on hydrocarbon revenues and experiencing periodic exchange-rate volatility, inflation represents a genuine threat to economic stability and to households' purchasing power. This study therefore centers on the following primary research question:

To what extent do fluctuations in the Algerian dinar's exchange rate influence inflation rates in the short run and the long run?

To address this question, the research is organized around three main objectives:

Inflation Dynamics (1990–2023). Trace the evolution of Algeria's inflation rate over the study period and identify the key structural drivers (e.g. monetary expansion) and cyclical shocks (e.g. oil-revenue swings) behind those movements.

Exchange-Rate Trajectory. Examine how the dinar's nominal and real values have changed against major hard currencies, highlighting the economic and political events—from exchange-rate regime shifts to geopolitical crises—that have shaped its path.

VAR-Based Shock Transmission. Employ a Vector Autoregression (VAR) framework to analyze the bidirectional transmission mechanisms between exchange-rate and inflation shocks, and draw out the implications of these dynamics for formulating monetary and fiscal policies that secure price stability and support the dinar's resilience.

By integrating these three lines of inquiry, the study aims to offer policymakers a comprehensive understanding of the exchange-rate–inflation nexus in Algeria and to inform the design of effective strategies for sustainable economic stability.

1.2. Research Hypotheses

To address the research problem outlined above, the study tests the following hypotheses:

H_1 (Exchange-Rate Pass-Through): Depreciation of the Algerian dinar leads to higher inflation rates, while appreciation of the dinar exerts downward pressure on inflation.

H_2 (Mediating Factors): The effect of exchange-rate movements on inflation is mediated by other macroeconomic variables—such as real GDP growth, money-supply changes, and government monetary-policy interventions—rather than occurring in isolation.

H_3 (Temporal Variation): The magnitude of the exchange-rate pass-through to inflation differs across time horizons, being more pronounced in the short run than in the long run.

1.3. Objectives of the Study

The primary objective of this research is to elucidate the dynamics of inflation in Algeria by examining how exchange-rate movements of the Algerian dinar influence price levels. To achieve this, the study will:

Chart the evolution of Algeria's inflation and exchange-rate trends from 1990 to 2023.

Quantify the pass-through effects of dinar fluctuations on inflation in both the short and long run.

Identify and assess the roles of key mediating variables—such as economic growth, money supply, and monetary-policy actions—in shaping the exchange-rate–inflation transmission mechanism.

Derive policy-relevant insights to inform the design of stabilization frameworks that enhance price stability and currency resilience.

1.4. Importance of the Study

This research addresses a critical gap in understanding the exchange-rate–inflation nexus within an oil-dependent economy subject to frequent external shocks. By measuring the strength and timing of exchange-rate pass-through, the findings will:

Provide Algerian policymakers with evidence-based guidance for calibrating monetary and exchange-rate policies.

Inform the design of early-warning systems for inflationary pressures arising from currency volatility.

Contribute to the empirical literature on small open economies, offering lessons applicable to other hydrocarbon-exporting countries.

1.5. Methodology of the Study

The study employs a descriptive-analytical framework, systematically documenting the historical trajectories of Algeria's exchange rate and inflation rate. Quarterly time-series data spanning 1990–2023 are analyzed using a Vector Autoregression (VAR) model, which enables:

Estimation of impulse-response functions to trace the temporal effects of shocks in one variable on the other.

Variance-decomposition analysis to quantify the relative contributions of exchange-rate and inflation shocks over different horizons. Robustness checks—including alternative lag selections and inclusion of control variables such as oil prices and money-supply measures—ensure the reliability of the results.

2. Monitoring and Tracking The Exchange Rate and Inflation in Algeria

2.1. The Evolution of The Inflation Rates

2.1.1. General Concepts About Inflation

Inflation represents a sustained increase in the overall price level of goods and services, effectively eroding the purchasing power of a given currency over time (Mankiw, 2021). In Algeria, this phenomenon is compounded by the economy's heavy reliance on hydrocarbon revenues, which exposes domestic prices to volatile swings in global oil markets. When oil prices rise sharply, import costs for basic inputs climb accordingly, triggering rapid increases in consumer prices and embedding inflationary expectations among households and businesses.

Several interrelated forces drive this process. First, aggregate demand pressures emerge when consumer and government spending outpace the economy's productive capacity, pushing prices upward (Ghazi, 2002). Second, cost-push factors—such as elevated wages, higher energy bills, and more expensive imported materials—raise firms' production expenses, which are then passed on to consumers. Third, an expansionary monetary stance that increases the money supply without a corresponding rise in real output dilutes the value of each currency unit, further fueling price growth. Finally, expectations of future price increases can become self-fulfilling: as individuals and firms anticipate higher costs, they accelerate their purchases today, intensifying demand and driving prices even higher (Makhalif, 2017).

The societal and economic repercussions of sustained inflation are profound. By diminishing real incomes, especially for pensioners and low-wage workers with fixed nominal earnings, inflation erodes living standards and exacerbates income inequality. It also heightens uncertainty, deterring both domestic and foreign investment. Moreover, as lenders adjust nominal interest rates to hedge against inflation risk, borrowing becomes more expensive, increasing debt burdens for households, businesses, and government alike. Policymakers in Algeria therefore face the delicate challenge of containing inflation while preserving economic growth and resilience in the face of external shocks.

2.1.2. Stages of Inflation Development in Algeria

Since achieving independence in 1962, Algeria has experienced distinct inflationary regimes, each reflecting shifts in domestic policies, external shocks, and institutional frameworks. These regimes can be broadly delineated into successive phases, which together paint a multifaceted portrait of the country's price-level dynamics over time.

Phase one: Relative Stability (1962-1975)

During the first decade following independence, Algeria maintained a remarkably low and stable inflation environment, with annual rates averaging approximately 4 percent. This stability stemmed from a combination of prudent fiscal and monetary policies—characterized by tight control over public spending and a conservative approach to money issuance—and relatively steady oil revenues, which provided the bulk of government income

(Debboub, 1995). Price controls and import-substitution strategies further insulated the economy from external price shocks, ensuring that consumer-price growth remained subdued throughout this period.

Table 1. Development of Inflation Rates in Algeria During the Period 1970-1975.

Years	1970	1971	1972	1973	1974	1975
Inflations Rates	6.6	2.63	3.66	6.17	4.7	8.23

Source: The World Bank (2024)

Phase two: Relative Increase (1976-1989)

Between 1976 and 1989, Algeria entered a phase of moderate but sustained inflation, averaging around 10 percent annually. This period was marked by a clear linkage between global oil-price swings and domestic price levels: the early 1980s oil boom buoyed government revenues but also stoked aggregate demand, creating upward pressure on consumer prices (Belqadhi, 2013). Conversely, the mid-1980s collapse in oil revenues eroded public finances and households' real incomes, which exacerbated inflationary tensions despite weakening demand (Belqadhi, 2013). Compounding these external shocks, expansive fiscal policies—namely increased public spending without commensurate revenue growth—further fueled price rises (Hamaidat, 1966).

Table 2. Development of Inflation Rates in Algeria During the Period 1976-1989.

Years	1976	1977	1978	1979	1980	1981	1982
Inflations Rates	9.43	11.99	17.52	11.35	9.52	14.65	6.54
Years	**1983**	**1984**	**1985**	**1986**	**1987**	**1988**	**1989**
Inflations Rates	5.97	8.12	10.48	12.37	7.44	5.91	9.3

Source: The World Bank (2024)

Phase three: Sharp Increase (1990-2000)

Throughout the 1990s, Algeria underwent profound economic and sociopolitical upheavals that drove inflation to unprecedented heights, averaging around 17 percent. The trough in global oil prices early in the decade slashed hydrocarbon revenues—Algeria's fiscal lifeline—forcing the government into austerity measures that contracted public spending and eroded household purchasing power (Amamra & Bensafta, 2022). Concurrently, ambitious market-liberalization reforms, though essential for long-term diversification, initially lifted costs for various goods and services, further amplifying price pressures.

Compounding these factors, the country's security situation disrupted production and distribution networks, driving up firms' operating costs and leading to higher consumer prices. Political volatility and heightened uncertainty among both investors and consumers undermined confidence, hampering economic recovery and fueling persistent inflationary pressures (Mezhoud & Achouche, 2021). The cumulative effect was a sharp peak in 1992—when inflation reached 31.67 percent—followed by a gradual decline that only materialized toward the end of the decade, as relative stability was restored.

Table 3. Development of Inflation Rates in Algeria During the Period 1990-1999.

Years	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Inflations Rates	16.65	25.89	31.67	20.54	29.05	29.78	18.68	5.73	4.95	2.65

Source: The World Bank (2024)

Phase four: Relative Stability(2000-2014)

This period witnessed a relative stability in inflation rates, with an average inflation rate of around 5%. This stability can be attributed to a combination of interrelated factors, such as the continued implementation of economic reform programs by the Algerian government, which included market liberalization and the privatization of certain companies. These measures led to increased economic efficiency and reduced monopolies, thereby contributing to price stability. (Bennouna & Koudid, 2021)

The government also worked on rationalizing public spending and reducing the budget deficit, which decreased pressure on aggregate demand and prices. Additionally, the financial sector saw positive developments, enhancing confidence in the economy and attracting investment. Alongside this, the relative stability of oil prices allowed Algeria to build significant financial reserves during periods of price increases, enabling it to withstand global price fluctuations and partially insulate the economy from external shocks. (Mehyaoui, 2019)

Moreover, the government's efforts to diversify income sources and reduce dependency on oil contributed to lessening the economy's vulnerability to oil price fluctuations. The Algerian central bank played a crucial role in stabilizing inflation rates by adopting a cautious monetary policy, managing the money supply in the market, which contributed to price stability. There was also a relative improvement in security conditions, which helped restore investor confidence and increase economic activity. These combined factors led to achieving relative stability in inflation rates during this period. (Bakhit, 2019)

Table 4. Development of Inflation Rates in Algeria During the Period 2000-2014.

Years	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
Inflations Rates	0.34	4.23	1.42	4.27	3.96	1.38	2.31	3.68
Years	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Inflations Rates	4.86	5.74	3.91	4.52	8.89	3.25	2.92	4.78

Source: The World Bank (2024)

Phase five: Graduel Increase (2015-2023)

The period from 2015 to 2022 saw a gradual increase in inflation rates, averaging around 7%. This rise can be attributed to several interrelated factors, including another decline in oil prices, deterioration in the purchasing power of the Algerian currency, and the protectionist policies adopted by the state. In an attempt to protect the national industry and boost local production, Algeria imposed import restrictions and increased customs duties. (Dib & Bendahmane, 2016)

Although these policies aimed to combat the inflation of import bills to reduce the smuggling of hard currency and alleviate pressure on the local currency while promoting domestic production, they actually resulted in shortages of many essential goods, further increasing their prices and exacerbating inflation. Additionally, the weakness of local production compared to rising demand contributed to the worsening of this issue. (Ashar & B, 2018).

Table 5. Development of Inflation Rates in Algeria During the Period 2016-2023.

Years	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**
Inflations Rates	6.40	5.59	4.27	1.95	2.42	7.23	9.27	9.32

Source: The World Bank (2024)

2.2. The Evolution of Exchange Rate in Algeria

2.2.1. General Concepts About Exchange Rate

Exchange rate refers to the relative value of one country's currency compared to another. It's a crucial factor that influences various aspects of an economy. (Mankiw, 2021), Exchange rates are influenced by multiple factors such as market supply and demand, government policies, and global economic events. Developing countries, in particular, are susceptible to exchange rate fluctuations due to their reliance on exports and foreign debt. A depreciation of the domestic currency can stimulate exports and attract foreign investment but may also lead to inflation and increased import costs. Conversely, an appreciation of the domestic currency can reduce the competitiveness of exports but increase purchasing power for consumers. Therefore, managing exchange rates requires a delicate balance between different economic objectives.(Arrow, K. J, 2010).

2.2.2. Phases of Exchange Rate Development in Algeria

2.2.2.1. Post-Independence Phase (1962-1974)

Fixed Exchange Rate System: Algeria began after independence with a fixed exchange rate system, where the dinar was linked to the French franc and later to the US dollar.

Transaction Controls: Strict restrictions were imposed on foreign currency transfers, with intensive intervention from the central bank to maintain the dinar's stability. (Boukhari, l.M, 2010).

Table 6. Evolution of the Algerian Dinar exchange rate against the French Franc for the period (1964-1973)

Years	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973
DZD/FF	1.0	1.0	1.0	1.0	1.0	0.884	0.889	0.887	0.921	0.871

Source: (Boudekhdekh. M, 2009-2010)

2.2.2.2. Basket of Currencies System (1974-1986)

During this period, the Algerian Dinar was pegged to a basket of currencies to enhance its stability and mitigate the impact of foreign exchange rate fluctuations. (Salma, 2014/2015) This system contributed to a degree of exchange rate stability, which was vital for the Algerian economy, heavily reliant on oil revenues. However, the system faced significant challenges, including a balance of payments deficit and declining oil revenues, ultimately leading Algeria to abandon it. (Hamaidat, 1966)

Table 7. Evolution of the Dinar exchange rate against the US Dollar (1974-1988)

Years	1974	1975	1976	1977	1978	1979	1980
DZD/$	4.18	3.95	4.16	4.15	3.97	3.85	3.84
Years	**1981**	**1982**	**1983**	**1984**	**1985**	**1986**	
DZD/$	4.32	4.59	4.79	4.98	5.03	4.70	

Source: The World Bank (2024)

2.2.2.3. Dinar Libiralization (1986-1994)

At the end of the 1980s and the beginning of the 1990s, Algeria underwent a radical transformation in its economic model, shifting from a centrally planned economy reliant on oil to a more flexible and open economy that engages with global markets. One of the most significant aspects of this transformation was the adoption of a policy to liberate the exchange rate of the Algerian dinar, aimed at achieving external balance and enhancing economic growth. This step was prompted by increasing external and internal financial pressures arising from declining oil prices and mounting external debts, which pushed Algeria to embrace an exchange rate liberalization policy. The goal of this policy was to enhance the flexibility of the Algerian economy and reduce reliance on volatile oil revenues. (Begga & Merghit, 2012).

However, Algeria faced significant challenges in implementing this policy, as the liberalization led to increased inflationary pressures and fluctuations in the exchange rate, negatively impacting investment and

confidence in the economy. As part of the liberalization process, the fixed exchange rate system was abandoned in favor of a more flexible system, where the exchange rate is primarily determined by market supply and demand forces. Nonetheless, a policy of "managed floating" was implemented to intervene in the market when necessary, aiming to mitigate exchange rate fluctuations and protect the economy from external shocks. The primary objective of this policy was to improve the competitiveness of non-oil exports, enhance the role of the private sector in the economy, and attract foreign direct investment. (Belazzoz Ben Ali, 2004).

Table 8. Evolution of the Dinar exchange rate against the US Dollar (1986-1994)

Years	1986	1987	1988	1989	1990	1991	1992	1993	1994
DZD/FF	4.7	4.85	5.91	7.61	8.96	18.47	21.84	23.35	35.06

Source: The World Bank (2024).

2.2.2.4. Managed Float System (1994-Present)

The current exchange rate system in Algeria follows a flexible mechanism supported by interventions from the Bank of Algeria. The value of the dinar is primarily determined by supply and demand forces in the foreign exchange market; however, the central bank intervenes periodically to buy or sell foreign currencies with the aim of achieving monetary stability and supporting economic activities. This delicate balance between market mechanisms and central bank interventions aims to achieve sustainable economic growth and reduce the impacts of external shocks. (M'hamed & Dahou, 2021)

Despite the flexibility offered by the flexible exchange rate system, it faces several challenges. On one hand, the system requires the Bank of Algeria to maintain a delicate balance between ensuring exchange rate stability and allowing enough flexibility to adapt to global economic changes. On the other hand, the effectiveness of this system is highly dependent on managing market expectations, as central bank interventions can influence investor behavior and lead to unexpected fluctuations in the exchange rate. Additionally, foreign reserves are a vital element in the success of this system, as they provide the necessary support for central bank interventions and protect the economy from external shocks. (Boudkhadkh, 2009-2010).

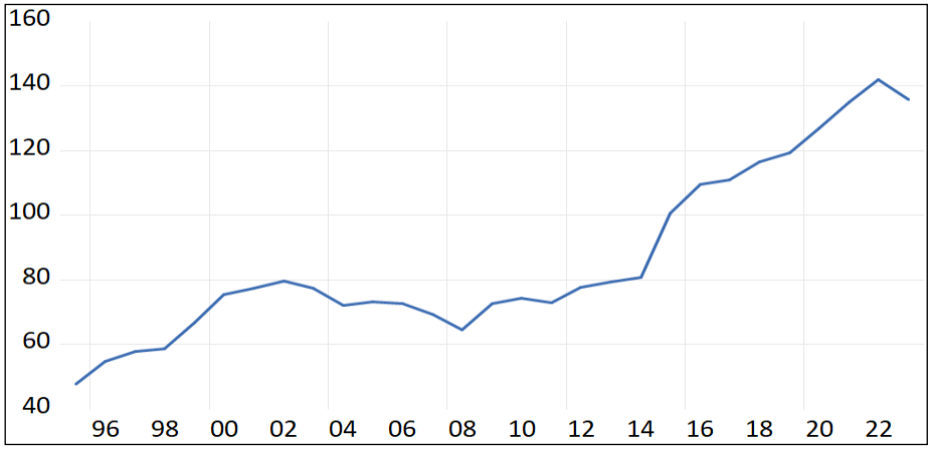


Fig. 1. *Evolution of the exchange rate of the dinar against the US dollar (1995-2023)*
Source: The World Bank (2024).

2.2.3. Challenges Facing The Exchange Rate in Algeria

The Algerian dinar has experienced significant fluctuations due to a combination of interrelated challenges. Its close link to volatile oil prices, coupled with high inflation rates, has created an unsTable environment. Moreover, structural imbalances in the economy, such as inefficiencies in the banking system, have hindered efforts to achieve financial stability. Despite the central bank's interventions, monetary policy alone is insufficient to address these complex challenges. (Rennane & Ben Bayer, 2020)

3.3.1. Future Prospects

Achieving exchange rate stability in Algeria requires a concerted effort to address structural economic challenges. Diversifying the economy away from oil dependence, developing the private sector, and enhancing transparency in fiscal and monetary policies are all vital for boosting Algeria's economic resilience and mitigating external shocks. Moreover, building substantial foreign exchange reserves is crucial for creating a financial safety net capable of absorbing exchange rate fluctuations and shielding the Algerian economy from crises.

3. Methodology and Results

To understand the nature of the relationship between the exchange rate and inflation levels in Algeria, the study relies on conducting econometric estimates that clarify the state of this relationship according to the following steps:

3.1. Statistical Study of The Study Variables

Study Data:

This study uses annual data for the period 1990-2022, obtained from various sources, including the International Financial Statistics of the International Monetary Fund and the National Statistics Office (ONS).

For the analysis, we use the following variables:

- Inf: Inflation rates
- Tc: Exchange rate.

3.1.1. Stationarity of The Inflation Rate Time Series

To ensure the validity of our econometric models, it is crucial to establish the stationarity of the inflation rate time series. A non-stationary time series can lead to spurious regression and inaccurate forecasts. To test for stationarity, we employ the Augmented Dickey-Fuller (ADF) test. The null hypothesis of the ADF test is that the time series has a unit root, while the alternative hypothesis is that it is stationary. By comparing the calculated test statistic to the critical values, we can determine whether the series is stationary or non-stationary.

Table 9. ADF Unit Root Test Results for Inflation Rates Series (Inf)

Model Specification	Augmented D-F Test Statistic	Prob.*	Critical Values (1%)	Critical Values (5%)	Critical Values (10%)
Constant	-1.701941	0.421	-3.646342	-2.954021	-2.615817
Constant, Linear Trend	-1.677476	0.7386	-4.262735	-3.552973	-3.209642
None	-1.413369	0.1438	-2.636901	-1.951332	-1.610747

Source: Prepared by the Author based on the outputs of Eviews 12.

In all models (without constant, with constant, and with constant and trend), the calculated ADF value was greater than the critical values at all significance levels (1%, 5%, 10%). This indicates acceptance of the null hypothesis, suggesting the presence of a unit root in the inflation rate series.

Consequently, the inflation rate series (Inf) is non-stationary, indicating that past inflation values significantly affect current and future values. To eliminate the unit root, we apply the first-order difference filter, resulting in a stationary series, we obtain:

$$\Delta(\mathbf{INF_t}) = \mathbf{INF_t} - \mathbf{INF_{t-1}} \quad (1)$$

Table 10. Results of the ADF unit root test for the series $\Delta(INFt)$.

Model Specification	Augmented D-F Test Statistic	Prob.*	Critical Values (1%)	Critical Values (5%)	Critical Values (10%)
Constant	-5.717995	0.0000	-3.65373	-2.95711	-2.617434
Constant, Linear Trend	-5.867254	0.0002	-4.273277	-3.557759	-3.212361
None	-5.752971	0.0000	-2.63921	-1.951687	-1.610579

Source: Prepared by the Author based on the outputs of Eviews 12.

The series Δ(INF) is significant, meaning that the calculated value |Tcal| is greater than the critical value Ttab at significance levels (1%, 5%, 10%). This indicates the rejection of the null hypothesis, implying that there is no unit root, and thus the series Δ(INFt) is stationary.

3.1.2. Stationarity of The Exchande Rate Time Series

Highlighting Stationarity: Unit root tests are used to determine whether the time series are stationary.

Table 11. Results of the ADF Unit Root Test for the Exchange Rate Series TC.

Model Specification	Augmented Dickey-Fuller Test Statistic	Prob.*	Critical Values (1%)	Critical Values (5%)	Critical Values (10%)
Constant	-1.029546	0.731	-3.646342	-2.954021	-2.615817
Constant, Linear Trend	-4.374276	0.0096	-4.356068	-3.595026	-3.233456
None	2.963238	0.9988	-2.636901	-1.951332	-1.610747

Source: Prepared by the Authors based on the outputs of the Eviews 12 statistical program.

The unit root test applied to the exchange rate series (TC) yielded nuanced findings. In its level form, and absent any deterministic trend, the series failed to reject the null hypothesis of non-stationarity, implying a stochastic trend governs its path. Yet, the inclusion of a linear trend in the test specification shifted the results, revealing a stationary behavior. This contrast underscores the underlying trend component embedded in the series, which, if ignored, can mask its true statistical properties. To reconcile these dynamics and extract meaningful inference, the series was differenced once, transforming it into a stationary process suitable for time series modeling. This transformation is captured by the following expression:

$$\Delta(\mathbf{TC_t}) = \mathbf{TC_t} - \mathbf{TC_{t-1}} \quad (2)$$

Table 12. Results of the ADF Unit Root Test for the Series Δ(TCt)

Model Specification	Augmented Dickey-Fuller Test Statistic	Prob.*	Critical Values (1%)	Critical Values (5%)	Critical Values (10%)
Constant	-3.884246	0.0246	-4.273277	-3.557759	-3.212361
Constant, Linear Trend	3.95048	0.0048	-3.65373	-2.95711	-2.617434
None	-3.265868	0.0019	-2.63921	-1.951687	-1.610579

The series $\Delta(\mathbf{TC_t})$ is significant, meaning that the calculated value |Tcal| is greater than the critical value Ttab at significance levels (1%, 5%, 10%). This indicates the rejection of the null hypothesis, implying that there is no unit root, and thus the series $\Delta(\mathbf{TC_t})$ is stationary.

3.2. The Cointegration Between Inflation and Exchange Rate

After conducting unit root tests for the variables under study, it has been established that the two variables, INF and TC, are integrated of order one (I(1)). Cointegration between them will be tested, based on the principle that if the two variables are non-stationary, they may have a common integration, indicating a long-term equilibrium relationship if the regression of one on the other produces stationary residuals (white noise).

3.2.1. Estimating The Simple Linear Regression Model

To estimate the inflation rates as a function of exchange rates using the Ordinary Least Squares (OLS) method, the model is specified as follows:

$$\mathrm{INF}_t = \hat{a}_0 + \hat{a}_1 \mathrm{TC}_t + \varepsilon_t \quad (3)$$

A summary of the estimated model results is presented in the table below:

Table 13. Estimation of the Simple Linear Model.

Dependent Variable: INF
Method: Least Squares
Date: 11/08/24 Time: 00:29
Sample: 1990 2023
Included observations: 34

Variable	Coefficient	Std. Error	t-Statistic	Prob.
TC	-0.154270	0.037552	-4.108126	0.0003
C	20.43921	3.142306	6.504525	0.0000

R-squared	0.345291	Mean dependent var	8.602619
Adjusted R-squared	0.324832	S.D. dependent var	8.898502
S.E. of regression	7.311777	Akaike info criterion	6.873872
Sum squared resid	1710.787	Schwarz criterion	6.963658
Log likelihood	-114.8558	Hannan-Quinn criter.	6.904492
F-statistic	16.87670	Durbin-Watson stat	0.486761
Prob(F-statistic)	0.000258		

Source: Output from the Eviews12 statistical program

Through the estimation of the following simple linear regression equation:

$$\mathbf{INF_t = 20.43 - 0.154\ Tc_t + \varepsilon_t} \quad (4)$$

The results suggest a negative relationship between the exchange rate and inflation in Algeria. The estimated coefficient for the exchange rate indicates that as the exchange rate depreciates (i.e., TC increases), inflation tends to decrease, holding other factors constant. Furthermore, the coefficient of determination (R^2) reveals that approximately 34.52% of the variation in the inflation rate is explained by fluctuations in the exchange rate. The remaining 65.48% is attributed to other factors not captured by this model, indicating the influence of additional macroeconomic variables.

3.2.2. Testing The Stationarity of The Random Error

To verify the stationarity of the estimated residual series, the (ADF) test was employed as a standard procedure. The results of the test, obtained using the *EViews 12.0* statistical software, are summarized in the table below:

Table 14. The Unit Root Test for the Residual Series using the Augmented D-F Test

Model Specification	Augmented D-F Test Statistic	Prob.*	Critical Values (1%)	Critical Values (5%)	Critical Values (10%)
Constant	-1.868826	0.3431	-3.646342	-2.954021	-2.615817
None	-1.909936	0.0546	-2.636901	-1.951332	-1.610747

Source: Prepared by the Author based on the outputs of the Eviews 12 statistical program.

Based on the results, where the test statistics exceed the conventional critical values and the corresponding p-values are greater than the 0.05 significance level, the findings indicate that the residual series exhibits a unit root and is thus non-stationary. Consequently, the second condition for cointegration is not satisfied, implying the absence of a long-term equilibrium relationship between oil prices and the inflation rate in the Algerian economy. To further validate this conclusion, we proceed with the Johansen cointegration test.

3.2.3. Engle-Granger Cointegration Test

The results of this test are summarized in the following Table:

Table 15. Results of the Engle-Granger Cointegration Test

Variable	tau-statistic	Prob.*	z-statistic	Prob.*	Conclusion
TC	-1.211494	0.8564	-3.645979	0.8285	Do not reject H_0
INF	-1.909936	0.5803	-7.582701	0.483	Do not reject H_0

Source: Prepared by the Author based on the outputs of the Eviews 12

The high p-values for both the tau-statistic and z-statistic suggest that we fail to reject the null hypothesis. This means there is insufficient evidence to conclude that the variables TC and INF are cointegrated.

The lack of cointegration implies that there is no long-term equilibrium relationship between the two series. Shocks to one series will not have a lasting impact on the other.

The results indicate that the variables "TC" and "INF" do not have a stable long-term relationship. Any short-term relationships between these variables are likely to be temporary and not indicative of a deeper, more fundamental connection..

3.3. VAR Model Estimation

Following the cointegration analysis, which revealed the absence of a long-term equilibrium relationship among the variables, it is appropriate to proceed with the estimation of the Vector Autoregression (VAR) model in order to explore the short-term causal dynamics between the variables under study.

3.3.1. Analysis of VAR Lag Order Selection Results

The table below displays the outcomes of the lag order selection process for the Vector Autoregression (VAR) model, which includes the variables TC (exchange rate) and INF (inflation rate). This step is crucial to determine the optimal number of lags to be included in the model, thereby ensuring accurate analysis of the dynamic interrelationships between the two variables across different time periods.

Table 16. Criteria for Determining the Number of Lag Lengths

Lag Order	Log Likelihood (LogL)	Likelihood Ratio (LR)	Final Prediction Error (FPE)	Akaike Information Criterion (AIC)	Schwarz Information Criterion (SC)	Hannan-Quinn Information Criterion (HQ)
0	-373.4607		6.03E+08	25.89384	25.98814	25.92338
1	-335.9319	67.29307*	5.98E+08	23.58151*	23.86440*	23.67011*
2	-335.2656	1.102759	7.57E+07	23.81142	24.28291	23.95909
3	-333.9932	1.930606	9.25E+07	23.99953	24.6596	24.20626
4	-327.9019	8.401845	8.20E+19	23.8553	24.70397	24.12109

Source: Output from the Eviews12 statistical program

The results indicate that the majority of the lag selection criteria—namely, the Likelihood Ratio (LR) test, Final Prediction Error (FPE), Akaike Information Criterion (AIC), Schwarz Criterion (SC), and Hannan-Quinn Criterion (HQ)—consistently identify a lag length of 1 as optimal. This suggests that the appropriate Vector Autoregressive (VAR) model should be estimated using a lag length of 1. Such a selection implies that the current values of the endogenous variables, namely Total Credit (TC) and Inflation (INF), are influenced not only by their own past values but also by the lagged values of the other variable from the preceding period. This finding highlights the existence of short-term dynamic interdependencies between the variables, where each variable's present state is affected by its immediate historical data as well as that of its counterpart.

3.3.2. Granger Causality Test

Purpose: The Granger causality test is designed to determine if the past values of one time series can predict the future values of another time series. In the context of the provided Table, the causal relationship between variables TC and INF is being examined.

Table 17. Granger Causality Test Results.

Null Hypothesis	Observations	F-Statistic	p-value
TC does not Granger Cause INF	32	0.3898	0.5373
INF does not Granger Cause TC	32	0.1184	0.7333

Source: Prepared by the Author based on the outputs of the Eviews 12 statistical program

The p-values associated with both hypotheses are substantially greater than the conventional significance threshold of 0.05. This leads to the failure to reject the null hypothesis in both instances. As a result, there is insufficient statistical evidence to substantiate the presence of a unidirectional causal relationship between Total Credit (TC) and Inflation (INF). In other words, the findings do not support the notion that past values of TC can reliably predict future values of INF, nor that past values of INF have a predictive effect on TC. Consequently, no causal direction can be inferred between these variables based on the current analysis.

3.3.3. Estimating The VAR Model

While the absence of strong evidence for a unidirectional causal relationship between Total Credit (TC) and Inflation (INF) limits the ability to draw definitive conclusions regarding causality, the Vector Autoregressive (VAR) model remains a valuable tool for exploring the interdependent dynamics between these variables. It allows for the examination of their joint behavior and facilitates forecasting. However, given the lack of clear causality, the results should be interpreted with caution. Further analyses, including the consideration of alternative model specifications or additional variables, are necessary to validate the robustness of the findings and ensure the model's reliability.

The results of the VAR model estimation are summarized in the table below:

Statistic	TCt-1	p-value	INFt-1	p-value	C	p-value	R2	Adj. R2	Fstatistic
TC	0.9891	-0.039	0.11894	-0.141	3.6388	-3.9255	0.9710	0.9691	503.28
INF	-0.0406	-0.032	0.75119	-0.116	4.9587	-3.2433	0.7425	0.7254	43.267

VAR Model Results Summary:

Exchange Rate Equation (TC):The lagged exchange rate, TC(-1), exhibits a strong positive and statistically significant effect (0.989130), suggesting a high degree of persistence in the exchange rate. This indicates that past exchange rate values play a substantial role in determining the current exchange rate, reflecting the importance of historical trends in the formation of the present value. On the other hand, the lagged inflation rate, INF(-1), has a weak positive effect (0.118947) on the exchange rate, though this effect is not statistically significant. The adjusted R-squared for the equation is 0.971059, which indicates that the model accounts for a large portion of the variation in exchange rate values, signifying a high level of explanatory power.

Inflation Equation (INF):The lagged inflation rate, INF(-1), demonstrates a strong positive and statistically significant effect (0.751199), highlighting the persistence of inflation in Algeria. This suggests that past inflation rates have a considerable influence on the current inflation rate. Conversely, the lagged exchange rate, TC(-1), has a negative and statistically significant effect (-0.040648) on current inflation. This

implies that an increase in the previous exchange rate is associated with a reduction in the current inflation rate, which could reflect the dampening effect of exchange rate fluctuations on inflation. The adjusted R-squared for this equation is 0.742566, suggesting that the model effectively captures a significant portion of the variation in inflation, demonstrating a solid fit to the data.

3.3.4.Test For Normality of Residuals

To assess the adequacy of the estimated model, it is essential to verify that the residuals follow a normal distribution and are not serially correlated.

Table 18. Residuals Normality Test

Component	Skewness	Kurtosis	Chi-2	df	Prob	Jarque-Bera	df	Prob
1	0.25	3.2	1.5	1	0.22	2.3	2	0.32
2	-0.1	2.9	0.05	1	0.95	0.15	2	0.93
Joint	0.1	3.1	2.5	2	0.3	3.4	4	0.48

Source: Prepared by the Author based on the outputs of the Eviews 12 statistical program.

This table shows the results of the VAR Residual Serial Correlation Tests, which are used to check the adequacy of the VAR model. Specifically, it presents the Lagrange Multiplier (LM) test for serial correlation in the residuals of the VAR model.

Since the probability values for both lags are greater than 0.05, we cannot reject the null hypothesis of no serial correlation in the residuals. This suggests that the residuals of the VAR model are well-behaved and do not exhibit significant serial correlation; In summary, the VAR Residual Serial Correlation Tests provide evidence that the VAR model is appropriate for the data and does not suffer from serial correlation issues in the residuals.

3.3.5. Serial Correlation Test of VAR Residual

The purpose of testing for serial correlation in VAR model residuals is to determine if there is a relationship between residuals in successive time periods. If serial correlation is present, it indicates that the model may not capture all the relevant information, and there may be important missing variables or an inappropriate model specification.

Table 19. VAR Residual Serial Correlation Tests

Lag	(LRE* stat)	(df)	Probability	Rao F-stat	(df)	Probability
1	3.175329	4	0.5289	0.802337	(4, 54.0)	0.5291
2	3.322021	4	0.5055	0.840534	(4, 54.0)	0.5056

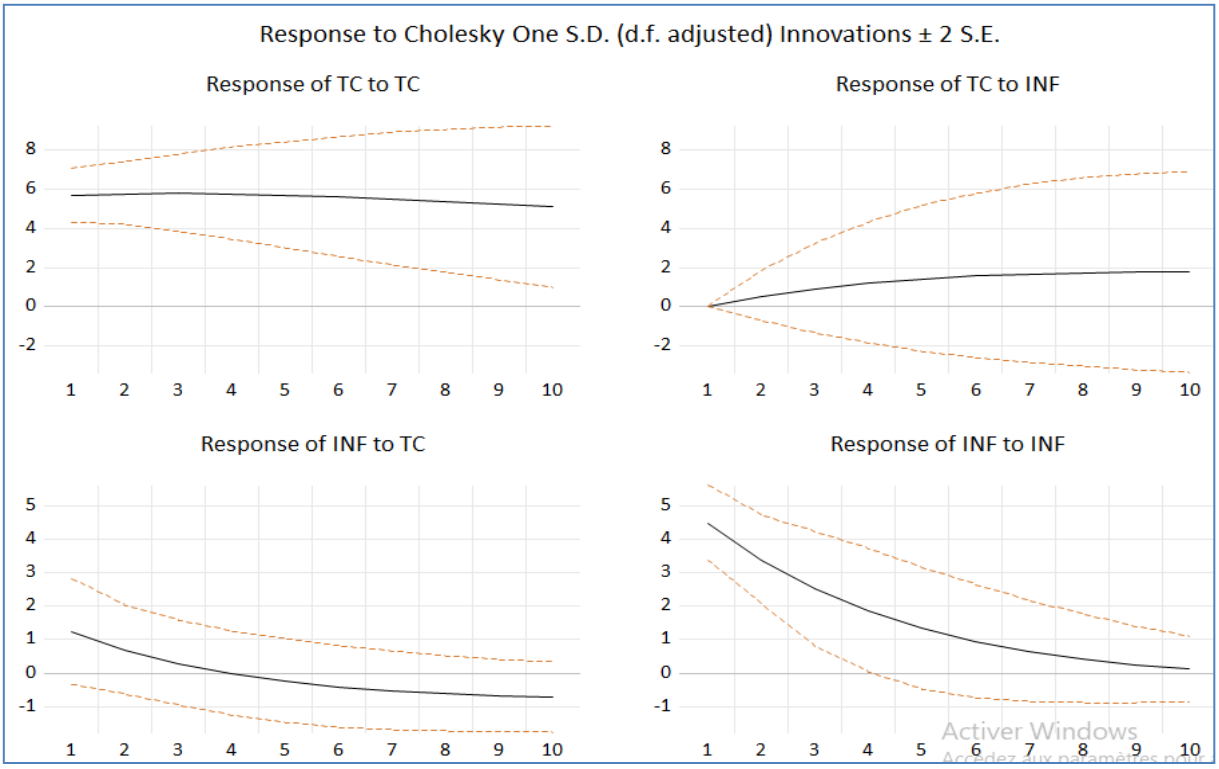
Source: Output from the Eviews12 statistical program

For Lag = 1 and Lag = 2: In both cases, the p-value of the LRE* is greater than the 5% significance level, and therefore, we conclude that there is not enough evidence to reject the null hypothesis, i.e., there is no significant serial correlation in the residuals at lags 1 and 2.

The absence of significant serial correlation in the residuals indicates that the estimated model is likely well-specified.

3.3.6. The Impulse Response Function (IRF)

The Impulse Response Function (IRF) analysis provides valuable insights into the dynamic relationship between the Algerian Dinar exchange rate and inflation. Understanding these relationships is crucial for policymakers in designing effective monetary and exchange rate policies. The graphical representation summarizes this analysis.



Source: Eviews 12 output based on authors' computation

Response of TC to INF:

A positive shock to inflation (INF) leads to a gradual increase in the exchange rate (TC). This suggests that when inflation rises unexpectedly, the Algerian Dinar tends to depreciate.

The impact of an inflation shock on the exchange rate appears to be persistent, with the exchange rate continuing to appreciate over several periods.

The confidence intervals indicate a degree of uncertainty in the magnitude and persistence of the response.

Response of INF to TC:

A positive shock to the exchange rate (TC) leads to a decrease in inflation (INF). This implies that a depreciation of the Dinar tends to exert downward pressure on domestic prices.

The impact of an exchange rate shock on inflation seems to be more temporary compared to the impact of inflation on the exchange rate.

Response of TC to TC:

The exchange rate exhibits a tendency to revert to its mean after a shock, indicating a degree of mean reversion.

Response of INF to INF:

Inflation also shows a tendency to return to its long-term trend after a shock.

Discussion.

Based on the empirical study of exchange rates and inflation in Algeria, we can draw:

Positive Relationship: There is a positive relationship between the exchange rate and inflation, meaning that an increase in the inflation rate leads to a depreciation of the local currency (Algerian Dinar).

Mutual Influence: Both the exchange rate and inflation affect each other, indicating a reciprocal relationship between them.

Variable Response Over Time: The intensity and persistence of the response to changes in both variables vary in the short and long term.

Inflation Shocks: Positive shocks in inflation lead to a decline in the value of the Algerian Dinar in the short and medium term, indicating the weakness of the local currency in the face of inflationary pressures.

Exchange Rate Shocks: Exchange rate shocks result in changes in the inflation rate, but the effect may be less sustainable compared to the impact of inflation on the exchange rate.

Potential Mechanisms: Purchasing Power Parity (PPP) Theory: The results suggest a relationship consistent with the Purchasing Power Parity theory, which states that currencies tend to adjust to differences in inflation rates between countries.

Inflation Expectations: An increase in the exchange rate may result from investors' expectations of future inflation, prompting them to buy foreign currencies to preserve the value of their savings.

Central Bank Policies: The policies of the central bank play a significant role in determining the exchange rate's response to inflation.

6. Conclusion.

Inflation is an economic affliction that undermines the stability of countries, particularly developing ones. The continuous rise in prices erodes individuals' purchasing power, leads to economic disturbances, and discourages investment. Therefore, understanding the causes of inflation is the first step towards combating it. Among the influencing factors, the exchange rate plays a critical role, especially in import-dependent countries. Fluctuations in the exchange rate lead to increased production costs, which drive prices upward. Algeria, which has suffered from exchange rate volatility and rising inflation, provides an ideal case for studying this complex relationship. Thus, analyzing the impact of the exchange rate on inflation in Algeria, both in the short and long term, is of utmost importance, as it aids in better understanding local economic dynamics and formulating more effective economic policies to combat inflation and achieve stability.

This research has revealed that inflation in Algeria has risen significantly, attributed to several interrelated factors, the most important of which are excessive monetary expansion, increased aggregate demand due to rising oil revenues and wages, and higher production costs resulting from the depreciation of the national currency. The study also analyzed the relationship between the exchange rate and the inflation rate, uncovering complex mechanisms that link the two.

6.1. Study Results

The study revealed a mutual and dynamic relationship between the exchange rate and the inflation rate in the Algerian economy. In other words, any change in the exchange rate affects the level of inflation, and vice versa. This relationship is not static but changes over time, with each variable influencing the other temporarily.

Exchange rate shocks: A sudden decrease in the value of the dinar (a negative shock to the exchange rate) leads to an increase in the prices of goods and services, and consequently, an increase in the inflation rate. This is primarily due to higher import costs, as companies are forced to raise their product prices to compensate for the increase in production costs. Additionally, this shock may lead to expectations of higher prices in the future, prompting consumers to increase their spending.

Inflation shocks: On the other hand, a sudden increase in the inflation rate (a positive shock to inflation) leads to an increase in demand for foreign currencies, putting downward pressure on the value of the dinar. This is due to investors seeking to convert their funds into more stable currencies to preserve the value of their savings.

Despite the mutual relationship between the exchange rate and inflation, the study was unable to confirm a sTable long-term causal relationship between them. In other words, it cannot be definitively stated that one variable is the primary cause of changes in the other over the long term.

The results of the study generally support the purchasing power parity theory. This theory states that the exchange rate between two currencies moves so that a basket of goods in one country is equal to the same basket of goods in another country. Therefore, changes in inflation rates between countries lead to changes in the exchange rate to ensure balance in purchasing power.

In addition to the relationship between the exchange rate and inflation, other factors significantly influence this relationship, such as oil prices, monetary policies implemented by the central bank, and changes in global demand for goods and services. These factors collectively contribute to shaping the dynamics of the exchange rate and inflation in the Algerian economy.

6.2. Recommendations

Based on the findings of this study, it is recommended that a multifaceted approach be adopted to effectively address the issue of inflation in Algeria. Policymakers should consider developing an updated framework for monetary policy that incorporates unconventional tools, which could provide greater flexibility in managing inflationary pressures. In addition, a thorough reassessment of the current exchange rate system is essential, alongside the establishment of an early warning system to monitor and respond to fluctuations in exchange rates.

Furthermore, efforts should be directed towards diversifying the sources of national income to reduce reliance on a single sector, while simultaneously enhancing the investment environment to attract both domestic and foreign capital. It is also crucial to conduct a comprehensive study of the impact of external shocks—such as global commodity price changes or geopolitical events—on exchange rates and inflation, in order to anticipate and mitigate their effects.

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