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The impact of changes in money supply and exchange rate on inflation rate in Algeria during the period 1990-2022 using the ARDL bound testing method

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***Abstract*---**The intent of this study is to use the ARDL Bound testing technique to examine the influence of changes in the money supply and exchange rate on Algeria's inflation rate from 1990 and 2022. The subject matter focuses on the fundamental ideas of money supply, exchange rate, and inflation. To solve the issue, a descriptive and econometric technique was applied and the results displayed an insignificant inverse link between inflation and the exchange rate in the long term, with the approach employed demonstrating stability and consistency.

***Keywords*---**Money Supply, Exchange Rate, Inflation, ARDL Bound Testing.

I- Introduction:

The Algerian economy has seen significant changes during the previous three decades, owing mostly to global and internal economic upheavals that have affected different economic indices, including inflation. Inflation is a major economic occurrence, offering a continual problem for authorities since rising inflation reduces people's financial leverage and threatens overall economic stability.

Both the money supply and currency rates have a significant influence on inflation. An increase in the money supply without equivalent increases in output might cause prices to rise. Similarly, swings in exchange rates have an impact on

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the pricing of imported products, which influences the inflation rate. Understanding the relationships between these economic variables is critical for establishing long-term economic stability.

The purpose of this study is to analyze the influence of changes in the money supply and exchange rates on inflation in Algeria from 1990 and 2022. To achieve this, the Autoregressive Distributed Lag (ARDL) Bound Testing model will be utilized, which is particularly successful at examining long-term connections between economic variables. The research seeks to give useful insights into how monetary policy and exchange rate changes affect inflation, allowing Algerian officials to make qualified, evidence-based decisions that promote economic stability and successfully manage inflation. The study will use historical data and econometric tools to verify that the outcomes are accurate and reliable.

I .1 Main Research Problem

Based on the foregoing, we ask the following question:
What effect will changes in the money supply and exchange rate have on Algeria's inflation rate from 1990 and 2022?

I .2 Sub-Questions

The major study topic may be divided into the following subquestions:
• What impact does the money supply have on Algeria's inflation rate from 1990-2022?
• How have exchange rate variations affected Algeria's inflation rate from 1990 to 2022?
• Is there a long-term stability connection between the money supply, exchange rate, and inflation rate from 1990-2022?

I .3 Research Hypotheses

In Algeria, there is a positive correlation between money supply growth and inflation rates. • Inflationary pressures are also influenced by exchange rate movements.
• A long-term equilibrium exists between the money supply, exchange rate, and inflation rate.

I .4 Objectives of the Study

• In Algeria, there is a positive correlation between money supply growth and inflation rates.
• Inflationary pressures are also influenced by exchange rate movements.
• A long-term equilibrium exists between the money supply, exchange rate, and inflation rate.
• Analyze the influence of money supply on inflation rate in Algeria from 1990-2022.
• Analyze how exchange rate movements affect inflation rates over the same time period.
• Using the ARDL Bound Testing model, assess if the money supply, exchange rate, and inflation rate are in long-term equilibrium.
• Recommendations to Algerian authorities based on study findings to strengthen inflation control tactics.

I .5 Methodology of the Study

To address the research problem posed in this study, we adopted both descriptive and econometric methods as follows:

Descriptive Method: Used to establish a theoretical framework for the study by collecting and analyzing information and data on money supply, exchange rates, and inflation.

Econometric Method: Employed to examine the impact of changes in money supply and exchange rates on the inflation rate in Algeria from 1990 to 2022.Here are the translated references

I .6 Previous Studies:

- **Study by Abdel Karim Mohamed:**
- The purpose of this study was to look at the link between currency rate fluctuations and inflation in Algeria between 2000 and 2016. The study employed field economic data and statistical studies to assess the influence of exchange rate variations on inflation rates. The data revealed a substantial association between exchange rate changes and rising inflation, emphasizing the crucial role of exchange rate stability in ensuring price stability.
- **Study by Youssef Abdullah:**
- This research compares the influence of the money supply on inflation in Algeria to other developing nations between 1990 and 2015. A variety of economic models and comparative analysis were employed to compare Algerian data to those of other nations. The findings showed that the money supply had a clear impact on Algeria's inflation rate, emphasizing the need of effective monetary policy in managing inflation.
- **Study by Bashir Ahmed:**

  This applied study used the ARDL model (Autoregressive Distributed Lag) to analyze the relationship between inflation and exchange rate in Algeria during the period from 1995 to 2018. The study relied on time series data and statistical analyses to determine the long-term relationship between the two variables. The results concluded that there is a long-term equilibrium relationship between inflation and the exchange rate, underscoring the importance of using this model in analyzing economic policies.
- **Study by Hassan Khaled:**
- This study examined Algeria's monetary policies and their influence on inflation rates from 1990 to 2020. The essay employed critical analytical techniques to assess the efficacy of various monetary strategies in lowering inflation and establishing economic stability. The findings underscored the importance of implementing tight yet flexible monetary policies in Algeria in order to reduce inflation and improve economic stability.

7.1 Research Structure:

I .7 Structure of the Study:

- Theoretical Literature on Money Supply
- General Concepts of Inflation
- A General Framework on Exchange Rate

- Applied Study

II– Theoretical Literature on Money Supply:

II.1 Money Supply: The idea of money supply varies by country and is defined in different ways. Overall, the money supply may be described as follows: The money supply is the entire means of trade and credit accessible at any one moment to individuals, companies, banks, and government entities.[1]
It also indicates the total number of payment instruments accessible in a country over a certain period. Monetary authorities, notably central banks, control these instruments, whether they are issued by the banking system or held in cash by people and enterprises.2. Central banks issue and regulate an economy's money supply, which is the total quantity of cash in circulation at any one moment.

II.2 Components of Money Supply:
II.2. 1 Liquid Assets: Also referred to as the "monetary base," these are liquid payment instruments accessible to individuals and institutions. Being fully liquid, they consist of three main types:

- Currency notes issued by the central bank.
- Coin currency held by individuals and businesses.
- Demand deposits, also known as checkable deposits, which are maintained by the institutions with which individuals and companies conduct business.

II.2.2. Near Money: These are not as liquid as currency but can be quickly converted into cash.
II.2.2.1 Gold and Foreign Currencies: The state accumulates gold and other foreign currencies through its financial operations and international commerce, despite the fact that these assets are not traded locally. These reserves are held by the central bank, which then uses them to issue local currency. Gold and foreign currencies represent the country's net balance of payments..[3]

II.2.2.2 Loans to the Treasury: on that case, the Treasury creates government debt instruments and makes them available for subscription on the money market. Central banks, commercial banks, and the general public can all subscribe to these securities. When the central bank subscribes, it exchanges legal money for the securities. If commercial banks or the public subscribe, they have the option of rediscounting these securities at the central bank to acquire legal money in exchange.[4]

II.2.2.3 Loans to the Economy: Commercial banks use the deposits and investments they receive to make loans to finance various projects and activities, therefore supporting and stimulating economic activity. When necessary, these banks may appeal to the central bank, which can rediscount commercial papers or provide loans as the financial system's lender of last resort. These loans are one of the key drivers of monetary issuance and have a considerable impact on the money supply.

III General Concepts of Inflation:

III.1 Definition of Inflation:

Inflation is a complicated, multifaceted process with several theoretical and practical implications. As a result, defining inflation is a challenging undertaking, fraught with ambiguity and inconsistencies due to divergent philosophical and theological viewpoints across economic schools of thought. Several definitions of inflation have been offered, including:

:

A steady and large increase in the overall price level. Akli depicts this occurrence as a condition of disequilibrium, underlining the importance of analyzing using dynamic rather than static criteria. 6 An rise in the quantity of money circulating in the economy, resulting in higher prices.7 Based on the above criteria, inflation may be defined as a sustained increase in the price level of goods and services within an economy, coupled by a fall in money's buying power, lowering its actual worth. While inflation is a normal occurrence in any economy, it becomes troublesome when it exceeds an acceptable level, reducing consumers' capacity to acquire goods and services with the same amount of money they previously had.

III.2 Manifestations of Inflation:

Various economic systems have experienced different types of inflation, including:

III.2.1 Discrimination Based on Government Price Supervision:

III.2.1.1 Suppressed Inflation:

Suppressed inflation occurs when prices are kept low by policies such as rules and procedures that limit overall spending and prevent price increases. This approach typically results in the acquisition of monetary and liquid assets, which may subsequently be converted into purchasing power.

III.2.1.2 Open Inflation:

Inflation happens when changes in demand for goods and services exceed changes in supply, resulting in a steady rise in prices. This sort of inflation occurs in the absence of government involvement to impose limitations or fix prices. [8]

III.2.1.3 Latent Inflation:

This sort of inflation takes place in economies governed by state-directed plans, such as those operating under a socialist system in which the state supervises numerous economic activities (including production, consumption, and distribution). Internal economic activity in these economies is frequently shielded from outside influences. As a result, liquid assets may accumulate, potentially creating excess demand. If the state fails to provide products and services at affordable costs, this might lead to inflation. [9]

III.2.2 Based on the Severity of Inflation:

III.2.2.1 Hyperinflation:

Hyperinflation is defined as a rapid and continuous increase in prices, which can occur from week to week or even day to day. This price increase causes more expenditures, which contributes to rising prices. Individuals are driven to spend money on items in order to prevent future price rises, resulting in a steady

depreciation in the value of money. In 1923, Germany experienced hyperinflation, which is a famous historical occurrence. .[10]

III.2.2.2 Creeping (Gradual) Inflation:

This sort of inflation is the polar opposite of hyperinflation, with prices rising slowly and steadily over time. Aggregate demand is moderate and reasonable. In some situations, nations may deliberately pursue this form of inflation in order to boost investment and economic development. [11]

IV. General Framework of Exchange Rates

IV.1 Concept of Exchange Rate

The value of one country's currency stated in terms of another, often known as the exchange rate.[12] The currency used to convert a specific number of units of the local currency for one unit of the foreign currency is known as the [13]

IV.2 Types of Exchange Rates

IV.2.1 Nominal Exchange Rate[14]**:** It's a measure of the worth of one country's currency compared to another, often known as the current exchange rate. It is governed by the supply and demand in the foreign exchange market at a given time, therefore it may fluctuate according to changes in supply and demand.

IV.2.2 Real Exchange Rate[15]**:** The real exchange rate between two currencies is calculated by adjusting the nominal exchange rate for differences in price levels between the two countries. The basic formula for the real exchange rate is:

$$\boldsymbol{TCR = TCN \times \frac{P}{P^*}}$$

where:

$\boldsymbol{P}$:Foreign price index

$\boldsymbol{P^*}$:Domestic price index

$\boldsymbol{TCN}$:Nominal exchange rate

IV.2.3 Effective Exchange Rate: This index analyzes the average change in a currency's exchange rate compared to many other currencies over a certain time period. The effective exchange rate index is an average of numerous bilateral exchange rates that shows how much a country's currency has gained or depreciated in comparison to a basket of currencies. It may be determined with the Laspeyres pricing index.

$$\boldsymbol{TCNE = \sum_P Z_P X_O^P (e_t^P / e_t^r) \sum_P X_O^P (e_O^P / e_0^r) \times 100}$$
$$\boldsymbol{TCNE = \sum_P Z_P (e^{pr})t / (e^{pr})o \times 100 \rightarrow \mathrm{TCNE} = \sum_P Z_P INER_{pr} \times 100}$$

where:

$\boldsymbol{(e^{pr})t}$ $\boldsymbol{(e^{pr})o}$ The exchange rate of a country's currency in terms of the local currency in the measurement year and the base year, respectively.:

$\boldsymbol{INER_{pr}}$The nominal bilateral exchange rate index in the measurement year compared to the base year ratio.ⁱ.

$\boldsymbol{e_t^P e_O^P}$:The exchange rate of the country's currency compared to the US dollar in the measurement year (t) or the base year 0

$\boldsymbol{e_t^r e_O^r}$: The exchange rate of the local currency valued in dollars in the measurement year (t) or the base year0

X_0^p : The value of exports to country (p) in the base year, denominated in its currency, which is used as a fixed weight for country (p) in calculating the Laspeyres index.
Z_P : The share of country (p) in the total exports of country (r), denominated in the currency of the latter.

IV.2.4 Real Effective Exchange Rate[16]**:** This figure is defined as the nominal effective exchange rate, adjusted for the relative prices of the nation in question and its primary trading partners. The primary purpose of calculating the real effective exchange rate is to examine changes in a country's pricing competitiveness in comparison to its trade partners. The standard calculation for the actual effective exchange rate, use the consumer price index, is:[17]

$$f_p = \sum_{i=0}^{n} w(i) \cdot f_p(i)$$

f_p :Real Effective Exchange Rate (REER)
$w(i)$: Bilateral Trade Weights
$f_p(i)$:Bilateral Real Exchange Rates
i : Trade-Partner Country
This formula helps assess the competitiveness of a country's prices for goods and services relative to those of its trading partners.

IV.2.5 Equilibrium Exchange Rate: The exchange rate at equilibrium is the rate that preserves overall economic balance and a sustainable balance of payments when the economy grows at its natural rate. It depicts the current exchange rate in an undistorted economic context. Understanding and calculating the equilibrium exchange rate is critical for establishing if the economy's present rate is near to this equilibrium level. According to this evaluation, a currency can be classed as undervalued or overpriced. Several variables affect the determination of the equilibrium exchange rate. [18]
Here is the translation:

V. Econometric Study

V.1 Study Model:

We can propose the following hypothetical model:

$$LINF_t = b_0 + b_1 LM_{2t} + b_2 LTx_t + \varepsilon_t$$

where:
$LINF$ **:** Logarithm of the Inflation Rate
LM_2**:** Logarithm of the Money Supply Volume
LTx **:**Logarithm of the Official Exchange Rate
ε **:** Random Error Term
t : Time

V.2 Stationarity Test:

The unit root test analyzes time series data to determine if it is stationary or has a unit root, which indicates non-stationarity. This analysis will be conducted using the Augmented Dickey-Fuller (ADF) test. The table below outlines the ADF test:

Table 01: Augmented Dickey-Fuller Test:

The level series		**LINF**	**LM2**	**LTX**
constant	**test statistic ADF**	-2.6343	-3.6385	-5.9789
	probability	0.0968	0.0108	0.0000
The constant and the overall trend.	**test statistic ADF**	-2.5736	0.6781	-2.1203
	probability	0.2938	0.9993	0.5113
Without a constant and overall trend.	**test statistic ADF**	-1.2809	0.9536	2.4347
	probability	0.1802	0.9053	0.9953
The first difference series		**d(LINF)**	**d(LM2)**	**d(LTX)**
constant	**test statistic ADF**	-7.8214	-4.9477	-6.5173
	probability	***0.0000	***0.0003	***0.0000
The constant and the overall trend	**test statistic ADF**	-7.9118	-5.6431	-6.277
	probability	***0.0000	***0.0004	***0.0001
Without a constant and overall trend	**test statistic ADF**	-7.938	-5.0274	-5.9709
	probability	***0.0000	***0.0000	***0.0000

Source: Prepared by the researcher based on outputs from Eviews9 (Appendix 02)

Significance Levels: 10% ***, 5% **, 1% * according to critical values from Mackinnon (1996) and lag order determined by the SIC criterion.

From the examination of Table 01, which presents the results of the unit root test, it is evident that the null hypothesis is accepted, indicating that all variables are non-stationary at the level due to the presence of a unit root. However, the variables become stationary at the first difference, as there is no unit root present at this stage. This suggests that all the study variables are integrated of order one (I(1)).

V.2.1 Cointegration Test Using the Bounds Testing Approach:

The following table presents the results of the calculation of the (F) statistic:

Table No. 02: Bounds Test (F Bounds Test):

Statistical test	**Value**	**K**	**Morale (%)**	**I (0)**	**I (1)**
F	**8.472412**	**2**	10	3.17	4.14
			5	3.79	4.85
			2.5	4.41	5.52
			1	5.15	6.36

Source: Prepared by the researchers based on the outputs of Eviews9 software (Appendix 01)

According to the preceding table, the F-statistic value falls under the critical boundaries for I(0) and I(1) at all levels. This shows the presence of a long-term equilibrium connection between the research variables.

V.2.2 Long-term Equilibrium:

To select the appropriate ARDL model for the study, we use the Schwarz Information Criterion (SIC). The resulting figure is as follows:

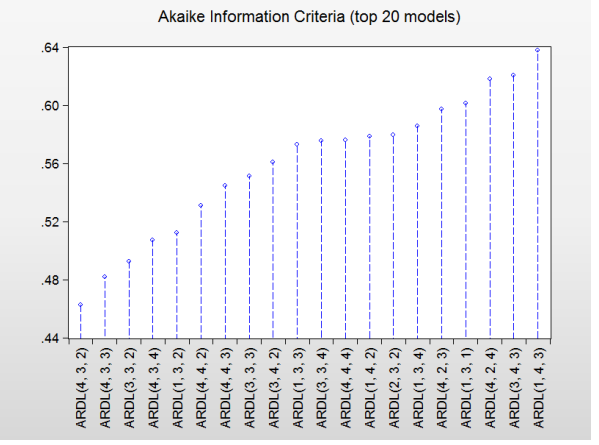


Figure No. 01: SIC Criterion

Source: Prepared by the researchers based on the outputs of Eviews9 software.

Based on Figure 02, which illustrates the residual correlation plot, the residuals display characteristics of white noise.

Figure No. 03: Cumulative Sum of Recursive Residuals (CUSUM)

Variable	Parameter	Standard Deviation	t-Statistic	*Probability
LINF(-1)	0.205521	0.194948	1.054234	0.3065
LINF(-2)	0.233212	0.198928	1.172345	0.2572
LINF(-3)	-0.315368	0.193572	-1.6292	0.1217
LINF(-4)	-0.309155	0.232678	-1.328683	0.2015
LM2	1.000628	1.376584	0.726892	0.4772
LM2(-1)	0.938431	1.431803	0.655419	0.521
LM2(-2)	-4.505495	1.330073	-3.387405	0.0035
LM2(-3)	2.72374	0.987621	2.75788	0.0134
LTX	3.265605	2.590938	1.260395	0.2246
LTX(-1)	0.517108	2.655522	0.194729	0.8479
LTX(-2)	-5.063963	1.95647	-2.588316	0.0191
C	1.651188	2.157011	0.765498	0.4545
(R2=0.7242), (F-statistic=4.0591 Pro=0.0049), (SIC=-1.0281)				

Source: Prepared by the researchers based on the outputs of Eviews9 software.

The table reveals that the coefficient for the logarithm of the money supply (LM2) is mostly positive, which is compatible with economic theory but statistically insignificant. Similarly, the coefficient for the logarithm of the exchange rate agrees with economic theory but is statistically insignificant.

The coefficient of determination (R^2) shows that 72.42% of the variation in the inflation rate is explained by the model's variables, namely the money supply and the exchange rate. Furthermore, the Fisher test confirms the overall significance of the model, which is accepted at the 1% level.

V.3 Error Correction Model: To select the appropriate ARDL model for the study, we use the Schwarz Information Criterion (SIC). The resulting table is as follows:

Figure No. 04: Cumulative Sum of Squares of Recursive Residuals (CUSUM of Squares)

Variable	Parameter	Standard Deviation	t-Statistic	*Probability
D(LINF(-1))	0.391311	0.259955	1.505299	0.1506
D(LINF(-2))	0.624522	0.286226	2.181922	0.0434
D(LINF(-3))	0.309155	0.232678	1.328683	0.2015
D(LM2)	1.000628	1.376584	0.726892	0.4772
D(LM2(-1))	4.505495	1.330073	3.387405	0.0035
D(LM2(-2))	-2.72374	0.987621	-2.75788	0.0134
D(LTX)	3.265605	2.590938	1.260395	0.2246
D(LTX(-1))	5.063963	1.95647	2.588316	0.0191
CointEq(-1)	-1.185789	0.243972	-4.860347	0.0001
Cointeq = LINF – (0.1327*LM2 -1.0805*LTX + 1.3925)				

Source: Prepared by the researchers based on the outputs of Eviews9 software.

Table No. 04 shows that the money supply coefficients are positive, implying that the money supply has a positive influence on the inflation rate in the near run. A similar observation may be made regarding the exchange rate coefficient. Furthermore, the error correction term is -1.185789, which is negative and statistically significant at the 5% level. This confirms the existence of a long-term equilibrium relationship and indicates that the model's error correction mechanism is operational, with the coefficient reflecting the rate at which the system returns to its long-term equilibrium.

Table No. 05: Long-term Coefficients

Variable	Parameter	Standard Deviation	t-Statistic	*Probability
LM2	0.132657	0.105721	1.25479	0.2265
LTX	-1.080504	0.933388	-1.157615	0.263
C	1.39248	1.816825	0.766436	0.4539

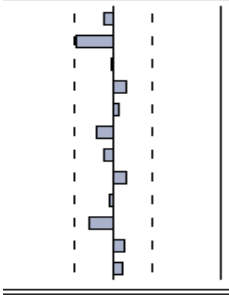
Source: Prepared by the researchers based on the outputs of Eviews9 software (Appendix 03).

$$L\inf_t = 1.39248 + 0.132657\ LM2_t - 1.080504\ LTx_t .....(01)$$

Table No. 05 demonstrates that the coefficient for the money supply is positive but not statistically significant, implying a modest positive link between inflation and the money supply in the long run. In contrast, the coefficient for the exchange rate is negative and not significant, demonstrating a weak inverse link between inflation and the exchange rate in the long run.

V.4 Residuals Test:

Date: 07/19/24 Time: 12:09
Sample: 1990 2022
Included observations: 29
Q-statistic probabilities adjusted for 4 dynamic regressors



Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob*
		1	-0.085	-0.085	0.2325	0.630
		2	-0.361	-0.371	4.5705	0.102
		3	-0.009	-0.097	4.5736	0.206
		4	0.126	-0.026	5.1431	0.273
		5	0.055	0.038	5.2583	0.385
		6	-0.159	-0.125	6.2417	0.397
		7	-0.095	-0.108	6.6143	0.470
		8	0.129	0.009	7.3305	0.501
		9	-0.044	-0.132	7.4194	0.594
		10	-0.239	-0.266	10.117	0.430
		11	0.109	-0.009	10.705	0.468
		12	0.084	-0.116	11.079	0.522

*Probabilities may not be valid for this equation specification.

Figure 02: Residual Correlation Plot
Source: Prepared by the researchers based on the outputs of Eviews9 software.

Based on Figure 02, which represents the residual correlation plot, the residuals are characterized by white noise, indicating that the residuals are randomly distributed and do not exhibit any systematic patterns.

V.5 Model Stability Test:

To ensure that the variables under study and the model as a whole are free from structural changes, we use the Cumulative Sum (CUSUM) test and the Cumulative Sum of Squares (CUSUM of Squares) test.

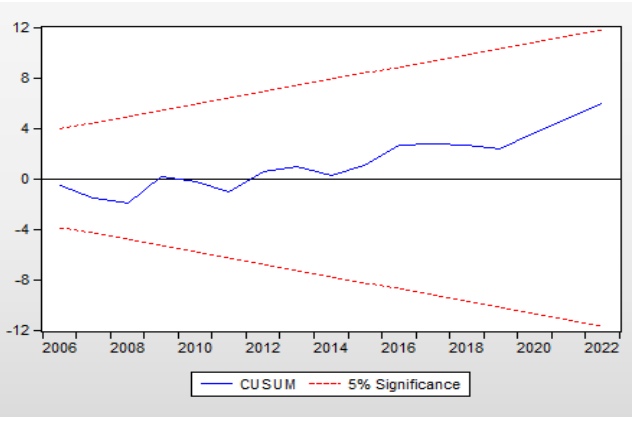


Figure 03: Cumulative Sum (CUSUM) of Recursive Residuals
Source: Prepared by the researchers based on the outputs of Eviews9 software.

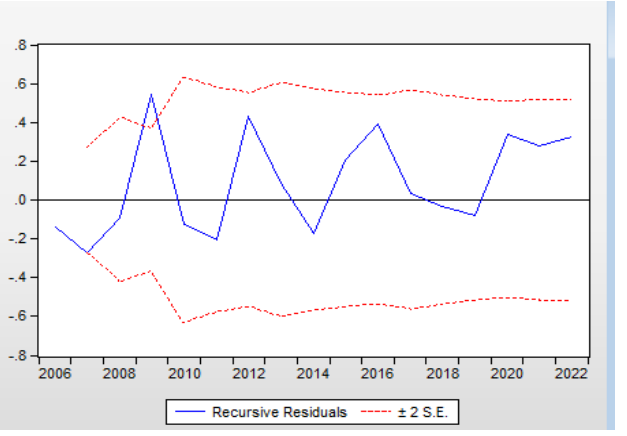


Figure 04: Cumulative Sum of Squares (CUSUM of Squares) of Recursive Residuals
Source: Prepared by the researchers based on the outputs of Eviews9 software.

Figures 03 and 04 indicate that the Cumulative Sum of Recursive Residuals (CUSUM) test falls inside the crucial zone, indicating that the model is stable at the 5% significance level. Similarly, the Cumulative Sum of Squares of Recursive Residuals (CUSUMSQ) test demonstrates stability. These findings suggest that the model retains coherence and stability in both long-term and short-term results.

VI. Conclusion:

Ultimately, understanding the dynamic link between the money supply, exchange rate, and inflation rate is critical to establishing long-term economic stability in Algeria. Using the ARDL Bound Testing model to analyze economic data from 1990 to 2022, we discovered a long-term equilibrium link between the variables under consideration.

Results:

- The study variables are integrated of the first order (I(1)).
- The variables have a long-term equilibrium relationship
- The money supply and exchange rate both have a positive impact on the inflation rate in the short term.
- Inflation rate and money supply have a weak positive correlation in the long term.
- Inflation rate and exchange rate have a weak inverse relationship.

Recommendations:

- Regulate money supply using monetary policy tools.
- Manage foreign currency markets and build reserves.
- To limit volatility, peg the Algerian dinar to a basket of currencies;
- Diversify the economy to reduce reliance on a single sector.
- Offer investment incentives to attract investments.
- Coordinate monetary, fiscal, and trade policies to achieve macroeconomic goals.
- Conduct awareness campaigns on money management and the impact of inflation and exchange rates.
- Improve the quality and availability of economic data to support analysis and policymaking;
- Analyze global economic developments and their impact on the Algerian economy.

VII. Appendices

Appendix01

UNIT ROOT TEST RESULTS TABLE (ADF)

Null Hypothesis: the variable has a unit root

		At Level		
		LINF	LM2	LTX
With Constant	t-Statistic	-2.6343	-3.6385	-5.9789
	Prob.	*0.0968*	*0.0108*	*0.0000*
		*	**	***
With Constant & Trend	t-Statistic	-2.5736	0.6781	-2.1203
	Prob.	*0.2938*	*0.9993*	*0.5113*
		n0	n0	n0
Without Constant & Trend	t-Statistic	-1.2809	0.9536	2.4347
	Prob.	*0.1802*	*0.9053*	*0.9953*
		n0	n0	n0
		At First Difference		
		d(LINF)	d(LM2)	d(LTX)
With Constant	t-Statistic	-7.8214	-4.9477	-6.5173
	Prob.	*0.0000*	*0.0003*	*0.0000*
		***	***	***
With Constant & Trend	t-Statistic	-7.9118	-5.6431	-6.2770
	Prob.	*0.0000*	*0.0004*	*0.0001*
		***	***	***
Without Constant & Trend	t-Statistic	-7.9380	-5.0274	-5.9709
	Prob.	*0.0000*	*0.0000*	*0.0000*
		***	***	***

Notes:

a: (*)Significant at the 10%; (**)Significant at the 5%; (***) Significant at the 1% and (no) Not Significant

b: Lag Length based on SIC

c: Probability based on MacKinnon (1996) one-sided p-values.

Appendix02

ARDL Bounds Test
Date: 07/19/24 Time: 11:30
Sample: 1994 2022
Included observations: 29
Null Hypothesis: No long-run relationships exist

Test Statistic	Value	k
F-statistic	8.472412	2

Critical Value Bounds

Significance	I0 Bound	I1 Bound
10%	3.17	4.14
5%	3.79	4.85
2.5%	4.41	5.52
1%	5.15	6.36

Appendix03

Dependent Variable: LINF
Method: ARDL
Date: 07/19/24 Time: 11:30
Sample (adjusted): 1994 2022
Included observations: 29 after adjustments
Maximum dependent lags: 4 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (4 lags, automatic): LM2 LTX
Fixed regressors: C
Number of models evalulated: 100
Selected Model: ARDL(4, 3, 2)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LINF(-1)	0.205521	0.194948	1.054234	0.3065
LINF(-2)	0.233212	0.198928	1.172345	0.2572
LINF(-3)	-0.315368	0.193572	-1.629200	0.1217
LINF(-4)	-0.309155	0.232678	-1.328683	0.2015
LM2	1.000628	1.376584	0.726892	0.4772
LM2(-1)	0.938431	1.431803	0.655419	0.5210
LM2(-2)	-4.505495	1.330073	-3.387405	0.0035
LM2(-3)	2.723740	0.987621	2.757880	0.0134
LTX	3.265605	2.590938	1.260395	0.2246
LTX(-1)	0.517108	2.655522	0.194729	0.8479
LTX(-2)	-5.063963	1.956470	-2.588316	0.0191
C	1.651188	2.157011	0.765498	0.4545

R-squared	0.724251	Mean dependent var	0.643555
Adjusted R-squared	0.545826	S.D. dependent var	0.390674
S.E. of regression	0.263285	Akaike info criterion	0.462345
Sum squared resid	1.178424	Schwarz criterion	1.028123
Log likelihood	5.295991	Hannan-Quinn criter.	0.639540
F-statistic	4.059121	Durbin-Watson stat	2.098941
Prob(F-statistic)	0.004940		

*Note: p-values and any subsequent tests do not account for model selection.

Apendix04

ARDL Cointegrating And Long Run Form
Dependent Variable: LINF
Selected Model: ARDL(4, 3, 2)
Date: 07/19/24 Time: 11:48
Sample: 1990 2022
Included observations: 29

Cointegrating Form

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LINF(-1))	0.391311	0.259955	1.505299	0.1506
D(LINF(-2))	0.624522	0.286226	2.181922	0.0434
D(LINF(-3))	0.309155	0.232678	1.328683	0.2015
D(LM2)	1.000628	1.376584	0.726892	0.4772
D(LM2(-1))	4.505495	1.330073	3.387405	0.0035
D(LM2(-2))	-2.723740	0.987621	-2.757880	0.0134
D(LTX)	3.265605	2.590938	1.260395	0.2246
D(LTX(-1))	5.063963	1.956470	2.588316	0.0191
CointEq(-1)	-1.185789	0.243972	-4.860347	0.0001

Cointeq = LINF - (0.1327*LM2 -1.0805*LTX + 1.3925)

Long Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LM2	0.132657	0.105721	1.254790	0.2265
LTX	-1.080504	0.933388	-1.157615	0.2630
C	1.392480	1.816825	0.766436	0.4539

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