



Impact exchange rate dinar/dollar on the volume of imports in Algeria analytical-econometric study since 2000-2024

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Abstract ;

The objective of this inquiry is to rigorously assess how fluctuations in the dinar-dollar monetary relationship have intricately influenced the trajectory of Algeria's international procurement trends, leveraging an analytical and econometric approach during the period (2000-2024). To describe the relationship between the study variables, factor analysis using principal components (ACP) was applied. To achieve this objective, the stability of the time series was examined using the Dickey-Fuller test, which indicated that there is no cointegration between the variables. Accordingly, the investigation employed a Vector Autoregression (VAR) framework, which reveals a statistically robust negative correlation between variations in Algeria's monetary valuation and the associated patterns in international procurement dynamics.

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1. Introduction

The issue of exchange rate is of significant importance, as a critical analytical instrument, this framework offers deep insights into the financial interactions of various nations by evaluating the repercussions of currency valuation on external accounts. Fluctuations in monetary parity serve as a cornerstone in reinforcing trust in the strategic oversight of external transaction policies, ensuring broader macroeconomic resilience and fiscal coherence. This has led researchers to target it to curb rising imports, notably in emerging and oil-producing economies.

In Algeria, the volume of imports has consistently increased since 2000, reaching \$59.67 billion in 2014, more than six times its level in 2000 (\$9.30 billion). Except for the relative recession in 2009 due to a reduction in Algeria's revenues caused by the global financial crisis and a decrease in demand for hydrocarbons, the country experienced a decline in import volume to \$35.42 billion in 2020 due to the health crisis and falling oil prices. However, the volume of imports began to increase again, reaching \$43.50 billion in 2024. This inquiry has compelled us to articulate our central research question: **How have fluctuations in Algeria's currency valuation influenced its external trade dynamics over the period 2000–2024?**

To delve deeper into the nuances of the topic, we put forth the following questions:

- Does a measurable relationship exist between currency valuation shifts and trade volumes?
- How sensitively does Algeria's trade activity adapt to fluctuations in currency parity?

To address these inquiries, we propose the following hypotheses:

- Variations in hydrocarbon prices exert a significant influence on currency valuation, thereby shaping Algeria's trade flows.
- A negative correlation exists between monetary depreciation and the scale of Algeria's external trade activities.

2. Theoretical Framework of Currency Valuation:

The value of a nation's currency is often expressed as the quantity of domestic monetary units necessary to acquire a single unit of a foreign currency (jamil, 2014). It is further conceptualized as the comparative worth of one country's currency relative to another (Pugel, 2016). Additionally, it signifies the relative valuation of one monetary unit against its counterpart in another economy.

The concept has been described as the rate at which one nation's currency can be

traded for another (Gerber, 2018) and as the comparative financial worth of a specific country's monetary unit relative to that of another sovereign entity (Paul R. krugman, 2012). There are two methods for determining currency prices, namely direct pricing and indirect pricing (Bozkri jamal, 2019).

- **Direct pricing:** Represents the number of foreign currency units required to obtain one unit of national currency. This method is used in a limited number of States, including Great Britain.

- **Absolute pricing:** Refers to the quantity of external monetary units exchanged for one unit of domestic tender, a system adopted by a select few nations, such as the United Kingdom.

- **Reciprocal pricing:** Describes the number of local currency units needed to obtain a single unit of international tender, a widely practiced method in most countries globally, including Algeria.

3. The Interplay Between Currency Valuation and Trade Flow Magnitudes:

A decline in the value of the national currency causes an increase in the domestic cost of foreign products, while their valuation in global monetary terms stays constant. Consequently, the volume of imports is expected to shrink, which will lead to a decrease in the quantity of foreign currency required. For consumer goods,

this devaluation impacts the quantity of imports, Depreciation leads to lower real income available for expenditure, resulting in lower consumption. This, in turn, reduces the actual consumption of internationally sourced goods. As for machinery and essential inputs, they often represent a significant proportion of the overall economic output. Henceforth, the impact of import reductions depends on developing countries' ability to replace imported raw materials and modify their production technologies to enable them to use locally produced raw materials (Ben Abdelaziz Samir, 2018).

Should the national currency appreciate or the government adjust its monetary valuation upward to mitigate the strain on trade equilibrium, this would amplify the inflow of foreign commodities, thereby augmenting the domestic market supply and exerting downward pressure on prices. This reduction is further facilitated if the cost of production is reduced as a result of lower costs of importing raw materials (Salma, 2015).

The international accounts framework identifies the drivers of domestic currency supply and demand. Inflows signify increased demand for local monetary units, reflecting an influx of foreign assets, while outflows represent their supply. A surplus, from greater outbound trade than inbound, raises demand for domestic currency, enhancing its value. Conversely, a deficit increases its supply, reducing its worth (Yahya, 2022).

4. Methodology and Procedures:

In this section, we will use the Principal Component Analysis (ACP) method, which relies on descriptive analysis of the data and thus does not depend on probabilities or hypotheses. This geometrical method is applied to tables that have variables with quantitative values in their columns and individuals in their rows (Sawalili, 2011) covering the years from 2000 to 2024. The primary determinant analyzed in this research is currency valuation, denoted as TC, while the secondary factor pertains to trade inflow volumes, represented as M.

Following the extraction of data from the World Bank database, the Principal Component Analysis (PCA) methodology was executed using XLStat2016 to derive outcomes, which will be elaborated upon subsequently. To quantify the interaction between currency valuation and trade inflows, a regression beam model was employed, utilizing the analytical capabilities of the EViews9.

4.1 Formulation of the Econometric Framework:

This analysis seeks to elucidate the dynamic interplay between currency valuation fluctuations and trade inflow magnitudes in Algeria. The requisite data for the relevant indicators were sourced from the World Bank and the National Office of Statistics. Accordingly, it is

posited that the functional relationship adheres to this specified structure:

$$LTC = a + B_1LM + e_i$$

- LTC denotes the natural logarithm of currency valuation.
- LM signifies the natural logarithm of trade inflow magnitudes.
- e_i represents the stochastic disturbance term.

This formulation facilitates the investigation of the log-linear association between currency valuation adjustments and trade inflow variations, incorporating the probabilistic characteristics of the dataset.

4.2 Analytical Framework and Methodological Approach:

This section utilizes advanced econometric techniques to assess the level of interdependence between currency valuation fluctuations and trade inflow dynamics in Algeria over the period 2000 – 2024. To achieve this, it is crucial to examine the stability of the time series, assess their degree of integration, and estimate suitable models.

The analysis will encompass the following steps:

Testing for Stationarity: We will conduct unit root tests (e.g., Augmented Dickey-Fuller test) to evaluate whether the time

series for the exchange rate and imports are stationary or non-stationary.

Determining the Order of Integration: If the series are found to be non-stationary, we will identify their order of integration to determine the number of differences required to achieve stationarity.

Model Estimation: Building on the outcomes of the preceding analytical procedures, suitable econometric frameworks, such as Vector Autoregression (VAR) and Vector Error Correction Model (VECM), will be employed to rigorously evaluate the interrelation between currency

valuation dynamics and trade inflow magnitudes.

This approach establishes a rigorous analytical foundation for comprehensively examining the intricate interplay between these variables throughout the designated timeframe.

5. Study Results (Analysis and Discussion)

5.1 Analytical Study Using Principal Component Analysis (ACP) for the Study Variables

5.1.1 Table of Means and Standard Deviations

Table 01. Summary of Descriptive Statistics

Variable	Observations	Minimum	Maximum	Moyenne	Ecart-type
LM	25	2.230	4.089	3.452	0.570
LTC	25	4.168	5.055	4.518	0.279

Source: Prepared by the researcher from the outputs of the *xlsata2016* software.

Analysis and Discussion:

Volume of Imports (LM):

Mean: The average volume of imports is 3.452, indicating a moderate level of imports over the study period.

Standard Deviation: With a standard deviation of 0.570, there is a reasonable degree of variability in the import volumes, suggesting fluctuations that could be influenced by various factors, such as

changes in exchange rates or economic conditions.

Currency Valuation (LT):

Arithmetic Mean: The central tendency is calculated at 4.518, representing the prevalent monetary benchmark for the examined timeframe, encapsulating the standard fiscal equilibrium under prevailing macroeconomic conditions.

Standard Deviation: A standard deviation of 0.279 indicates relatively lower

volatility compared to the volume of imports, suggesting that the exchange rate has been more stable during this period.

between the exchange rate and the volume of imports in Algeria.

LTC variants are involved in the concentration of the population under

study, as it has a smaller standard deviation (0.279). In contrast, the variable LM accounts for the dispersion of the studied population, given its larger standard deviation (0.570).

5.1.2 Correlation matrix, eigenvalues, and proportion of variance explained by the axes.

Table 02 Correlation Matrix

Variables	LM	LTC
LM	1	0.394
LTC	0.394	1

Source: Compiled by the researcher utilizing the outputs of XLStat2016.

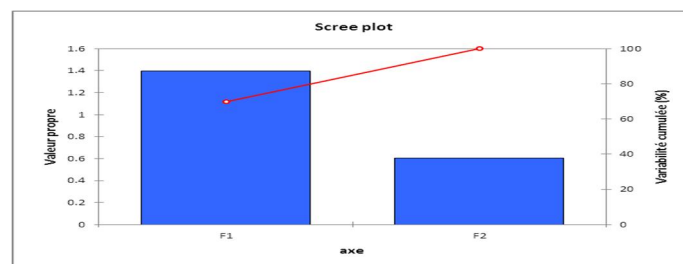
A significant direct relationship is observed with the LM metric. LTC variable exchange rate, where an association coefficient of 0.394 was recorded.

Table 03. Eigenvalues and Proportional Representation on Axes

	F1	F2
Valeur propre	1,394	0.606
Variabilité (%)	69,722	30.278
% cumulé	69,722	100,000

Source: Compiled by the researcher utilizing the outputs of XLStat2016.

Figure 01 Visualization of Principal Component

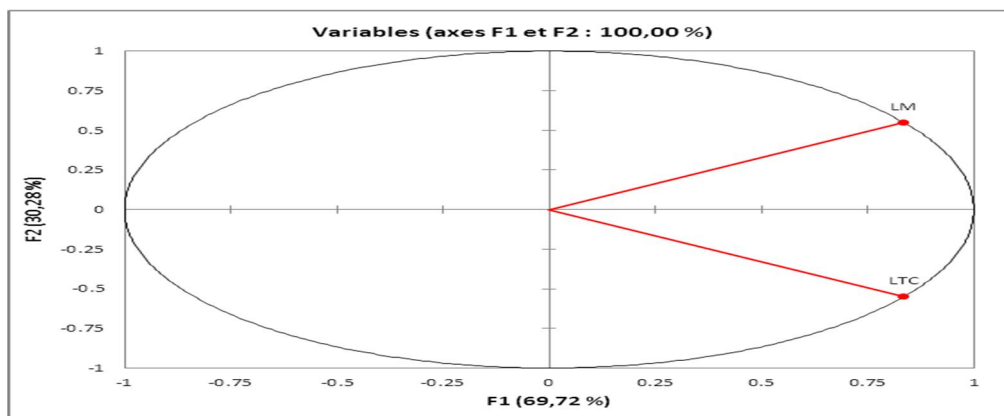


Source: Outputs of the xlsata2016.

As the primary dimension F1 accounts for 69.722% of the total variance, while the secondary dimension F2 contributes 30.278%, it can be concluded that the total ratios of the first and second axis (F1 and F2) reach 100% and therefore these two axes are better planned.

5.1.3 Graphical Representation of Variables

Figure 02 Graphical Representation of Variables

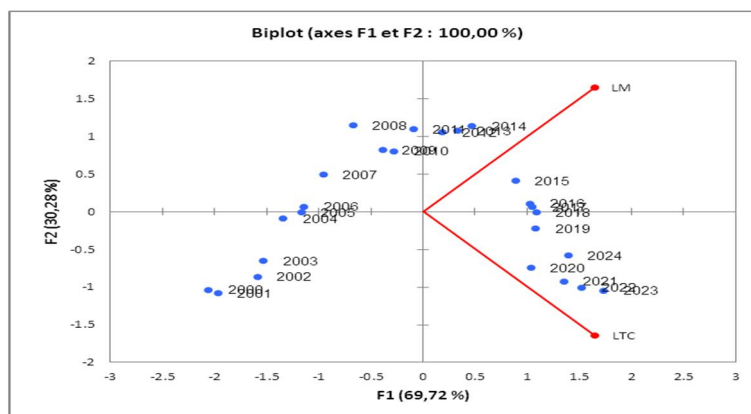


Source: Outputs of the xlsata2016.

The diagram illustrates that the metrics are significantly dispersed, residing away from the nucleus and gravitating toward the margins, indicating their quality and acceptance in the study. We also note that the Euclidean distance between LM and LTC is minimal, suggesting a strong positive correlation between them.

5.1.4 Graphical Representation of Variables and Individuals (Years of Study)

Figure 03 Graphical Representation of Variables and Individuals



Source: Outputs of the xlsata2016.

The depiction of the chronological span reveals that the interval commencing from 2010-2024 is well represented on the first axis (F1) with positive values, the temporal interval spanning 2000 to 2005 is effectively delineated by negative coordinates along the corresponding axis. Drawing upon the schematic portrayal of the parameters, it can be inferred that the Algerian economy experienced an increase in import volume between 2000 and 2005, while the exchange rate remained at acceptable levels. From 2006 to 2009, the economy underwent a transitional phase with significant changes, marked by a weakening in economic performance and a contraction in national revenues due to the global financial crisis, leading to decreased demand for hydrocarbons. Conversely, from 2010 to 2024, Algeria recorded an increase in import volume, driven by rising oil prices, although this did not improve

exchange rate levels, which significantly deteriorated.

5.2 Measuring the impact of the dinar/dollar exchange rate on Algeria's imports.

5.2.1 Series Installation Studies

Table (04) presents the results of unit root tests conducted using the Augmented Dickey-Fuller and Phillips-Perron tests, applied to the variables in their logarithmic form at the level and first difference.

Three models were tested: one including a general trend and constant, one with only a constant, they are not predetermined nor static. This assessment aims to evaluate the intrinsic properties of the chronological dataset and confirm its consistency. The outcomes are displayed in the accompanying table.

Table 04 Outcomes of the Augmented Dickey-Fuller Test at Level

Variables		ADF	
		Tt	Tc
LM	Model 6	3.61-	1.02-
	Model 5	-2.99	-2.88
	Model 4	-1.95	1.84
LTC	Model 6	3.61-	-1.75
	Model 5	2.99-	-0.07
	Model 4	-1.95	1.59

Source: Compiled by the researcher utilizing Eviews9 .

The preceding table illustrates the temporal dynamics of the examined parameters. The data exhibit the presence of a unit root, as the computed test statistic surpasses the threshold value, indicating that the null hypothesis cannot be refuted while the alternative hypothesis is invalidated.

Consequently, the sequence lacks stability at its initial state. Given the non-stationary nature of the dataset and the confirmed presence of a unit root, the analysis proceeded with the computation of first-order differences, the findings of which are summarized in the subsequent table.

Table 05 Results of the ADF Test at First Differences

Variables		ADF	
		Tt	Tc
LM	Model 6	-3.62	-4.49***
	Model 5	2.99-	-3.23***
	Model 4	-1.95	-2.81***
LTC	Model 6	3.62-	-3.10***
	Model 5	2.99-	-3.20***
	Model 4	-1.95	-3.07***

Source: Compiled by the researcher utilizing Eviews9 .

***, **, * indicate significance levels of 1%, 5%, and 10%, respectively.

The table above indicates that the time series for the variable at first differences (volume of imports) does not contain a unit root, Test statistics are below critical values at indicative levels of 10%, 5% and 1%.

This implies that the null hypothesis is invalidated, while the alternative proposition, asserting that the sequence attains stationarity at the first level of differencing I (1), is corroborated. Given that the dataset related to currency valuation demonstrates the presence of a

unit root and exhibits non-stationary behavior, a second-order differencing process is implemented. The corresponding outcomes of this examination are encapsulated in the subsequent tabular representation.

Table 06. Results of the ADF Test at Second Differences

Variables		ADF	
		Tt	Tc
LTC	Model 6	-3.64	-4.76***
	Model 5	-3.00	-5.41***
	Model 4	-1.95	-5.53***

Source: Compiled by the researcher utilizing Eviews9.

*, **, *** Indicates significance levels of 10%, 5%, and 1%, respectively.

The table above indicates that the time series for the variable at second differences (exchange rate) does not contain a unit root, Test statistics are below critical values at indicative levels of 10%, 5% and 1%. This indicates the invalidation of the null proposition and the validation of the competing hypothesis, affirming that the series achieves stationarity at the level of the second-order differentiation (I(2)).

5.2.2 Estimation of the Vector Auto regression (VAR) Model and Testing Its Validity:

Estimation of the Vector Auto regression (VAR) Model:

Before testing and assessment, the optimal lag structure of the VAR framework must

be ascertained utilizing the Akaike Information Criterion (AIC) and the Schwarz Bayesian Criterion (SBC) as guiding benchmarks. Using Eviews9, the results are shown in Annex 01. VAR model for variables under consideration, i.e. LTC exchange rate and LM imports, is written. Using Eviews9, as shown in Appendix 02, we obtained the following equation:

$$D(LM)_t = 0.03 + 0.30D(LM)_{t-1} - 0.32DD(LTC)_{t-1}$$

(1.25) (1.44) (-0.91)

N=22

 $F_c = 2.01$ $R^2 = 17.50\%$

(.):t- statistic

Statistical Interpretation:

The import volume equation can be evaluated through the following points:

- The equation representing the dependency structure reveals that neither the lagged values of international inflows nor the delayed coefficient of currency valuation exhibit statistical significance at the 5% threshold. However, the constant term demonstrates substantial statistical relevance at this significance level.
- The coefficient of determination is relatively low, signifying that the explanatory variables account for merely 17.50% of the variability in the modeled equation, with the remaining proportion attributable to unexplained deviations or stochastic error terms.
- Generally, the model lacks statistical significance according to the Fisher statistic.

$$F_c = 2.01 < F_t^{\alpha=0.05} = 3.42$$

The parameter associated with currency valuation exhibits a negative sign, implying

an inverse correlation between fluctuations in currency values and the magnitude of external procurements. Specifically, a 1% appreciation in currency valuation leads to a 0.32% contraction in procurement volumes during a given period.

5.2.3 Model Validity Tests:

Stability of Residuals:

Through the Ljung-Box test (see Appendix N 03), It is observed that the Q-statistic registers a value of 10.93, which falls below the critical Q-table threshold of 32.67. We accept the null hypothesis H_0 , which states that all autocorrelation coefficients are equal to zero. Therefore, the residual series is stable and represents white noise.

Normality Test:

We observe that the Jarque-Bera statistic (see Appendix N 04) is less than $\chi_{0.05,23}^2=32.6$ at the 5%. It therefore accepts the empty hypothesis and concludes that the remaining sequence follows a natural distribution.

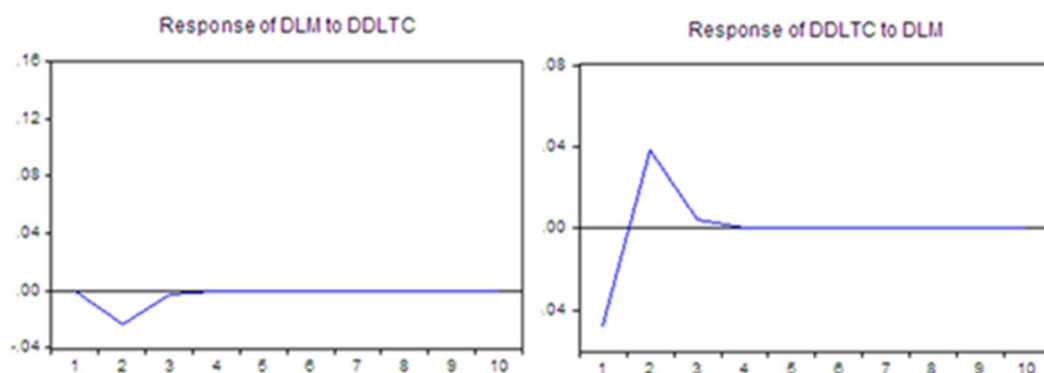
5.2.4 Analysis of Impulse Response Functions:

Autoregressive models and error correction models allow for analyzing random shocks by measuring the effect of a sudden shock in one variable on another.

In this study, we apply a shock to exchange

rate metrics in the first period, then examine its effect on import volume over a period of ten years, with results displayed in the following figure:

Figure 04 Visual Depiction of the Analysis of Stochastic Disturbances



Source: Outputs of the Eviews9 .

Occurrence of a Shock in Imports: when a shock of approximately -0.5 is applied to imports, we observe a negative response in the exchange rate, with some positive responses occurring in certain periods (2 and 3).

Occurrence of a Shock in the Exchange Rate: when a shock of approximately -0.3 is applied to the exchange rate, we notice a negative response in imports, which also stabilizes after the third period (long-term).

5.2.5 Variance Analysis:

The results of the variance decomposition, as shown in Appendix 05 for imports, indicate that the only component in the short term is the imports themselves, representing 100%. This percentage significantly decreases in the

long term, reaching 97.052% by year 3, while the exchange rate represents 2.94% by year 10 and stabilizes through year 10.

From the outcomes of the variance decomposition pertaining to currency valuation detailed in Appendix 05, we can see that the only component in the short term is itself, accounting for 70.69%. This percentage decreases in the long term to 60.14% by year 3 and stabilizes through year 10.

Conclusion:

This research evaluates the influence of fluctuations in the Algerian dinar relative to the United States dollar on Algeria's international procurement activities over the timeframe 2000–2024, relying on theoretical frameworks and applying

Principal Component Analysis (PCA), as well as estimating a Vector Autoregression (VAR) model. Key findings include:

Results:

- The exchange rate serves as a means to link the economies of different countries.
- The ACP test showed a strong positive correlation between import volume (LM) and the exchange rate (LTC), with a correlation coefficient of 0.394.
- The time series stability test revealed that the series are non-stationary at the original level but stabilized at first and second differences at the 1%, 5%, and 10% levels, indicating a lack of integration.
- This means that when the exchange rate rises, Algeria's imports fall.
- The reaction function to external shocks illustrates that procurement activities diminish following an adverse deviation in monetary metrics influenced by a decrease in fossil fuel valuations.
- The outcomes revealed that fluctuations in currency valuation exhibit an adverse reaction when international procurement is impacted by negative perturbations arising from volatility in oil markets and macroeconomic downturns
- The findings derived from the variability decomposition analysis indicate that currency valuation dynamics significantly

account for long-term shifts in international procurement trends.

Recommendations:

In conclusion, it is essential to promote local production as a substitute for imports to alleviate pressure on the national currency. Investments should also be encouraged in productive sectors such as agriculture and industry, rather than the hydrocarbons sector. This would contribute to improving the national currency's value against foreign currencies, positively impacting the overall economic situation.

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7. Appendix List:

Appendix RAM (01): Delay Level of the Series

VAR Lag Order Selection Criteria
Endogenous variables: DLM DDLTC
Exogenous variables: C
Date: 03/06/24 Time: 11:21
Sample: 2000 2024
Included observations: 19

Lag	LogL	LR	FPE	AIC	SC	HQ
0	30.90197	NA	0.000164	-3.042313	-2.942898	-3.025488
1	37.17061	10.55770*	0.000130*	-3.281116*	-2.982873*	-3.230642*
2	38.55970	2.047091	0.000174	-3.006285	-2.509211	-2.922160
3	40.86488	2.911801	0.000218	-2.827882	-2.131980	-2.710108
4	45.17090	4.532655	0.000231	-2.860095	-1.965363	-2.708671

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Appendix Number (02): Results of Estimating The VAR (Vector Autoregression) Model.

Vector Autoregression Estimates
Date: 03/06/24 Time: 11:27
Sample (adjusted): 2003 2024
Included observations: 22 after adjustments
Standard errors in () & t-statistics in []

	DLM	DDLTC
DLM(-1)	0.302288 (0.20991) [1.44012]	0.226735 (0.14483) [1.56556]
DDLTC(-1)	-0.324809 (0.35641) [-0.91133]	-0.204469 (0.24591) [-0.83147]
C	0.038554 (0.03072) [1.25512]	-0.023502 (0.02119) [-1.10892]
R-squared	0.175049	0.184037
Adj. R-squared	0.088212	0.098146
Sum sq. resids	0.310093	0.147620
S.E. equation	0.127753	0.088145
F-statistic	2.015841	2.142686
Log likelihood	15.66452	23.82907
Akaike AIC	-1.151320	-1.893552
Schwarz SC	-1.002541	-1.744773
Mean dependent	0.058501	-0.008500
S.D. dependent	0.133790	0.092817
Determinant resid covariance (dof adj.)		8.96E-05
Determinant resid covariance		6.69E-05
Log likelihood		43.30877
Akaike information criterion		-3.391706
Schwarz criterion		-3.094149

Appendix Number (03): Results of the Ljung-Box Test

Appendix Number (03): Model Validity Test.

Null Hypothesis: RESID01 has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=4)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-5.215940	0.0022
Test critical values:		
1% level	-4.467895	
5% level	-3.644963	
10% level	-3.261452	

*MacKinnon (1996) one-sided p-values.

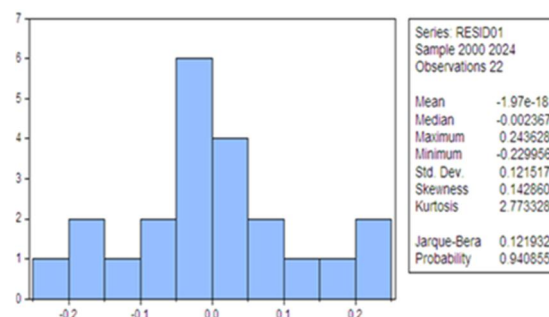
Augmented Dickey-Fuller Test Equation
Dependent Variable: D(RESID01)
Method: Least Squares
Date: 03/06/24 Time: 11:34
Sample (adjusted): 2004 2024
Included observations: 21 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RESID01(-1)	-1.198074	0.229695	-5.215940	0.0001
C	0.138289	0.069451	1.991178	0.0619
@TREND("2000")	-0.009854	0.004608	-2.138245	0.0465
R-squared	0.601852	Mean dependent var	-0.000359	
Adjusted R-squared	0.557613	S.D. dependent var	0.176215	
S.E. of regression	0.117204	Akaike info criterion	-1.318231	
Sum squared resid	0.247264	Schwarz criterion	-1.169014	
Log likelihood	16.84143	Hannan-Quinn criter.	-1.285847	
F-statistic	13.60464	Durbin-Watson stat	1.940659	
Prob(F-statistic)	0.000251			

Appendix Number (04): Results of the Jarque-Bera Test.

Date: 03/06/24 Time: 11:36
Sample: 2000 2024
Included observations: 22

Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob
		1 -0.00...	-0.00...	7.E-05	0.993
		2 -0.04...	-0.04...	0.0468	0.977
		3 0.313	0.314	2.7737	0.428
		4 0.210	0.228	4.0640	0.397
		5 -0.02...	0.015	4.0809	0.538
		6 0.066	-0.01...	4.2264	0.646
		7 -0.10...	-0.28...	4.6316	0.705
		8 -0.12...	-0.24...	5.2271	0.733
		9 -0.10...	-0.21...	5.6528	0.774
		1... -0.01...	0.063	5.6639	0.843
		1... -0.12...	0.136	6.3682	0.848
		1... -0.29...	-0.10...	10.931	0.535



Appendix Number (05): Analysis of Variance.

Variance Decomposition of DLM:			
Perio...	S.E.	DLM	DDLTC
1	0.127753	100.0000	0.000000
2	0.140815	97.07772	2.922275
3	0.140885	97.05271	2.947288
4	0.140886	97.05271	2.947292
5	0.140886	97.05270	2.947296
6	0.140886	97.05270	2.947296
7	0.140886	97.05270	2.947296
8	0.140886	97.05270	2.947296
9	0.140886	97.05270	2.947296
10	0.140886	97.05270	2.947296

Variance Decomposition of DDLTC:			
Perio...	S.E.	DLM	DDLTC
1	0.088145	29.30776	70.69224
2	0.097461	39.75893	60.24107
3	0.097586	39.85554	60.14446
4	0.097586	39.85553	60.14447
5	0.097586	39.85555	60.14445
6	0.097586	39.85555	60.14445
7	0.097586	39.85555	60.14445
8	0.097586	39.85555	60.14445
9	0.097586	39.85555	60.14445
10	0.097586	39.85555	60.14445

Cholesky Ordering: DLM DDLTC			
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