ITJ | The International Tax Journal

The strategy of economic enterprise to monitor inflation, through the relationship between developments in the money supply and inflation: Case study of Algeria

Amal Dahmani [1], **Walid Latreche** [2] and **Abdelhamid Bouabdelli** [3]

[1] Doctor, University of Médéa, (Algeria), Email: amelkawtar2812@gmail.com
[2] Lecturer (A), University Center of Tipaza, Research Laboratory in Applied Economics for Resources Governance and Territorial Development, (Algeria), Email: latreche.walid@cu-tipaza.dz
[3] Doctor, University of Algiers3, (Algeria), Email: bouabdelli.abdelhamid@univ-alger3.dz

Abstract---This research studies the response strategy of economic institutions to inflation, through the relationship between inflation and the money supply. This study relied on the analysis of time series for the study variables in Algeria during the period from 1988 to 2023 and presented the appropriate econometric modeling for the economic relationship between inflation and the money supply using the cointegration test in both the short and long term during this period, utilizing standard analytical methods. The study reached several conclusions, the most important of which is the existence of an impact of inflation on the financial situation of economic institutions, in addition to a causal relationship between inflation and the money supply, as well as the existence of a cointegration relationship between both variables in Algeria during the study period, which requires economic institutions to develop a strategy to study changes in inflation, in response to developments in the money supply.

Keywords---economic institutions, inflation, money supply, cointegration.

Introduction

The business environment is considered the foundation for long-term economic development of economic activities, and for sustainable improvement of economic performance and living standards in any country. The business environment consists of a set of external factors that influence companies,

How to Cite:
Dahmani, A., Latreche, W., & Bouabdelli, A. (2025). The strategy of economic enterprise to monitor inflation, through the relationship between developments in the money supply and inflation: Case study of Algeria. *The International Tax Journal*, *52*(3), 408–430. Retrieved from https://internationaltaxjournal.online/index.php/itj/article/view/70

The International tax journal ISSN: 0097-7314 E-ISSN: 3066-2370 © 2025

Submitted: 05 Feb 2025 | Revised: 09 March 2025 | Accepted: 04 May 2025

their decisions, and overall strategy, which are represented by: political, economic, social, technological, and legal factors. Together, these form the context in which companies operate, and their impact is particularly evident on small and medium-sized enterprises, which are the basis for development in many economies of certain countries. Collectively, these factors determine the potential for business growth, innovation, and sustainability in the medium and long term, and these companies contribute to GDP, employment, and innovation, yet their success and growth depend on the quality of the business environment.

Inflation is considered an economic ailment that has burdened companies and countries, as researchers have worked hard to study this phenomenon, attempting to analyze its effects and find ways to address it and avoid its dangerous repercussions on economic institutions, especially since both developed and developing countries suffer from it equally. The term inflation has garnered the attention of many researchers across various schools of economic thought, especially since it is one of the most important indicators showing the extent of the state's control over the economic situation and its stability.
Inflation affects the business environment and companies mainly through a decrease in the availability of financing through credit, rising interest rates, the impact of inflation on rising prices, consumer demand, and the strategic planning of companies, as well as long-term planning related to uncertainty and the unpredictability of the financial situation of economic institutions. Therefore, these institutions must develop a strategy to monitor inflation developments. Perhaps the most important factors determining changes in inflation are the money supply. From this, we can pose the research problem: "To what extent can economic institutions determine the level of inflation through its relationship with the money supply?".

2. The concept of inflation

Although there are many definitions of inflation, they all agree that it represents the continuous rise in prices. Inflation can be defined as follows:

Inflation is the continuous increase in the prices of goods and services in the economy over a certain period of time[1]. It also expresses a persistent upward movement of prices characterized by self-sustaining persistence resulting from excess demand exceeding supply capacity. In other words, inflation is the ongoing rise in prices due to increased demand for goods and services and a shortfall in production to meet this demand.

Inflation is defined as the continuous increase in the general price level. There are two points regarding this definition that need to be emphasized. First: the increase in prices must be sustained, not just a one-time increase in prices forever. Secondly: the general price level must be on the rise; increases in individual prices that are compensated by falling prices are not inflationary[2].
The term inflation generally refers to a general, permanent, and sustained increase in the prices of goods and services[3].

From these definitions, it becomes clear that inflation is a measure of the gap resulting from an imbalance of excess demand over supply due to an increase in the amount of circulating money. This leads to an upward trend in the general price level, resulting in the depreciation of the currency. In other words, it is the continuous rise in the general price level due to deficiencies in supply and an increase in

[1] Gregory Mankiw, Principles Of Economics, Seme Edition, Cengage Learning Education, Usa, 2018, P: 813.
[2] David G. Pierce, Peter J. Tysome, Monetary Economics Theories, Evidence And Policy, 2éme Édition, Butterworth Education, Great Britain, 1985, P: 190.
[3] Zahira Bouhassoun Bedjaoui, La Relation Monnaie-Inflation Dans Le Contexte De L'économie Algérienne, Thèse Doctorat En En Sciences Economiques, Spécialité: Gestion, Université Aboubakr Belkaïd- Tlemcen, 2014/2013, P: 48.

total demand pressure, resulting from an increase in the amount of money that exceeds the quantity of goods available. Thus, inflation refers to the following[4]:

- ✓ That inflation is a continuous movement that can be observed over a long period ;
- ✓ That inflation is a movement of prices because its fundamental phenomenon is the rise in prices ;
- ✓ The continuity of price movements towards continuous increases, and that inflation is not a temporary condition due to a shortage of supply, but it is characterized by cumulative increases in prices ;
- ✓ The inability of production institutions to meet the demand for goods and services due to a gap between demand and supply of these goods and services, and it is difficult to bridge the difference between the two within a short period of time due to obstacles faced in expanding production, such as those related to full employment or resource utilization and others.

Indicators and measures of inflation

Inflation refers to the continuous rise in the general price level, and the measures and economic indicators differ in how they calculate the inflation rate (or the rate of change in the general price level). Among them are: the GDP deflator, the consumer price index, the wholesale price index, the demand surplus standard, and the monetary stability surplus standard.

The GDP deflator

The GDP deflator is calculated by dividing the gross domestic product at current prices by the gross domestic product at constant prices in a given year, multiplied by one hundred. This index includes the prices of all goods and services available in the economy, making it a general measure of inflation rates for the year. Despite its importance, it presents problems in that most countries either do not conduct it or can only calculate it annually and, in the best cases, every three years. Consequently, it is often available with a delay of several months. Additionally, there is the issue of including the prices of services provided by the administration, which are arbitrarily assessed. Furthermore, it poorly reflects the rise in domestic spending prices in the event of deteriorating terms of trade[5]. Therefore, the GDP deflator measures the average price of all goods and services produced in the economy. The following formula is used to calculate this index[6]:

$$\text{The GDP deflator} = \frac{\text{Nominal GDP}}{\text{Real GDP}} \times 100$$

Consumer Price Index

This index is one of the most important indicators for measuring the inflation rate and is also the most widely used. Unlike the GDP deflator, it is considered a fixed-weight index. The Consumer Price Index (CPI) is calculated through annual reports published monthly by the relevant authorities in each country, using a market basket that an average urban consumer purchases monthly. The quantities of each item in the basket used for weighting are based on extensive consumer surveys[7]. The goods and services included in the consumption basket are classified into several categories that vary from country to country. The Laspeyres formula is used to calculate the Consumer Price Index (CPI), in which prices are weighted by base year weights, adjusting each good or service according to coefficients that represent the relative weight of these goods and services in the average spending of a typical household. It is calculated as follows[8]:

---

[4] Thamer Alwan Al-Musleh, Knowledge of Micro and Macro Economics, 1st edition, Dar Al-Ayyam for Publishing and Distribution, Jordan, 2015, p: 239.

5 Abdelmajid Qadi, Introduction to Macroeconomic Policies: An Analytical Evaluative Study, 4th edition, University Publications Office, Algeria, 2017, PP:46-47.

[6] William A. Mceachern, Macroeconomics: A Contemporary Introduction, 8éme Édition, South Wistern Édition, Usa, 2009, p: 480.

[7] Karl E. Case, Ray C. Fair, Sharon M. Oster, Principles Of Economics, 10éme Edition, Pearson Education, Usa, 2012, P: 448.

[8] Bakhti Ibrahim, Hattahat Al-Saeed, A Predictive Study of the Inflation Phenomenon in Algeria during the period (2002-2020), an article submitted to the Journal of Financial, Accounting, and Administrative Studies, Volume: 07, Issue: 02, University of Arab Ben Mehidi Um El Bouaghi, Algeria, 2020, p: 235.

$$INF_t = \frac{CPI_t - CPI_{t-1}}{CPI_{t-1}} \ 100$$

Where:

INF: Inflation rate (using the consumer price index);
CPI: Consumption at current prices during year t;

Standard of the Monetary Stability Factor

This standard contributes to measuring the inflation gap, in which the economist Friedman linked inflation to the imbalance between the increase in the money supply and the increase in real national output. He believes that an increase in the money supply at a rate greater than the increase in real national output generates excess demand that pushes prices upwards. This occurs through an increase in the total demand for goods and services in the economy at a rate that exceeds the increase in the quantity of goods and services available. The monetary stability coefficient is calculated using the following equation[9]:

$$\mathbf{B = \frac{\Delta Y}{Y} - \frac{\Delta M}{M}}$$

Where:
ΔM: The change in the money supply;
ΔY: The change in GDP.

According to this equation, stability is achieved when the relative change in the money supply equals the relative change in the gross domestic product, and the value of the coefficient B is equal to zero. However, if the relative change in the money supply is greater than the relative change in the gross domestic product, the stability coefficient B is positive, indicating the presence of inflationary pressures.

Excess Demand Standard

This standard for measuring the inflation gap is based on the fundamental premises of the effective demand concept in determining price levels according to the ideas of economist Keynes in the General Theory of Employment, Interest, and Money, which sees that any increase in the total demand for goods and services not matched by a corresponding increase in the real supply means that the economy has reached a stage of full employment, representing a state of inflation that drives local price levels to rise[10].

The surplus demand is measured using the:

$$\mathbf{D_x = (C_p + C_g + I + \Delta S) - Y}$$

Where:
$\mathbf{D_x}$: The inflation rate during the period (Demand surplus index);
$\mathbf{C_p}$: Consumption expenditure;
$\mathbf{C_g}$: Government spending;
I: Investment spending;
ΔS: Spending the local economy on foreign products;
Y: Gross domestic product at constant prices.
If the total national expenditure at current prices (CP + Cg + I + ΔS) exceeds the Gross Domestic Product at constant prices Y, this indicates a surplus in demand which manifests as an increase in the

[9] Abdel Mottalab Abdel Hamid, Monetary Policy and Independence of the Central Bank, 1st edition, University Publishing House, Egypt, 2013, p: 171.
[10] Ben Youssef Nawa, The Impact of Inflation on Macroeconomic Variables: An Empirical Study of the Case of Algeria during the Period 1979-2012, Unpublished Doctoral Thesis, Specialization in Applied Economics, Mohamed Khodira University, Biskra, Algeria, 2015/2016, p. 106.

prices of goods and services. Foreign transactions from exports and imports affect effective demand and consequently inflation.

4. The impact of inflation on economic institutions

The goal of the profit and loss statement is to show revenues, expenses, and the resulting outcome. However, in periods of financial inflation accompanied by a decrease in the real value of money, the profit and loss account will appear non-comparable due to the fluctuating value of currency from one period to another. Therefore, the result can only be correct if the information it is based on is accurate and built on sound principles and values. However, inflation makes the task of measurement difficult due to discrepancies in values, especially concerning depreciation and deferred expenses that lead to a decrease in the real value of money. Depreciation is calculated based on the historical values of fixed assets, which are expressed in a currency that has values different from that of the financial year. As a result, reported net profits appear higher than they should be.

Goods are also affected by financial inflation, as the continuous rise in prices reflects on all prices, including the goods produced by that economic unit. Inflation leads to a noticeable decrease in their volume, which necessitates an increase in the capital allocated for their production.

The economic institution must take the inflation factor into account, as taxes are calculated based on profit; therefore, the higher the profit value, the more corporate profits tax increases. Additionally, the share of profits distributed to owners will be greater than their actual value.

The rise in inflation leads to an increase in the real exchange rate, which in turn results in higher prices for local goods and an increase in the value of imports. This weakens the external competitiveness of economic institutions in the industrial sector. Enterprises active in the industrial and agricultural sectors may lose market share due to competition from cheaper imported goods, making competition in global markets more difficult due to rising production costs and the real exchange rate. Meanwhile, goods and services that cannot be imported, such as non-tradable goods in sectors like construction, security, and education, remain protected from these factors. Institutions tend to invest in the construction and real estate sector as it is more stable and profitable. The inflation resulting from rising oil prices raises the value of both imported and local goods, leading to a decrease in the purchasing power of individuals[11].

The effects of inflation on economic institutions can be summarized as follows:

[11] Michael L.Ross, The Oil Curse: How Petroleum Wealth Shapes the Development of Nations, Princeton University Press, the United Kingdom, 2012, p:47.

5. Model description and stability study of the variables

Inflation: We relied on annual inflation rates as an indicator of the general price level and one of the prominent indicators that affect economic institutions, which will be denoted by the symbol INF. The data was obtained from the sources approved by the Bank of Algeria.

Money supply: It is the M1 monetary aggregate plus time deposits held at banking institutions, namely the central bank and commercial banks. The M2 monetary aggregate is considered the broadest monetary aggregate that the monetary authority can monitor, and it is represented by the symbol M2. The data was obtained from the Bank of Algeria.

1- Presentation of the Model

After identifying and defining the variables and determining the dependent variable that expresses the phenomenon under study and the independent variable, the natural logarithm will be applied to the study variables in order to interpret the parameter estimates based on elasticities, as well as to eliminate the issue of heteroscedasticity of the residuals. To study the relationship between the money supply and inflation in Algeria during the period 1988-2023, we relied on some theoretical approaches and previous studies and reached the following model:

$$LINF_t = a_0 + a_1 LM2_t + \varepsilon_t$$

LINF: The logarithm represents the inflation rate in Algeria during period t and it is the dependent variable in the model.

LM2: The logarithm represents the money supply in Algeria during period t, and it is the independent variable in the model.

ε_t : It represents the random error.

α_0: The constant limit, 1α, represents the response coefficient of the dependent variable to the independent variable.

Descriptive statistics of the study variables

The following table presents some descriptive statistics for the variables, which include the mean, median, maximum value, minimum value, standard deviation, along with the skewness coefficient, kurtosis coefficient, and the Jarque-Bera statistic:

Table (01). Descriptive statistics of the study variables

Statistical Variables	LM2	LINF	Statistical Variables	LM2	LINF
Mean	7,822030	1,653690	Kurtosis	1,645148	3,660920
Median	8,045506	1,572739	Jarque-Bera	3,099805	0,819093
Maximum	9,779035	3,455686	Probability	0,212269	0,663951
Minimum	5,410753	-1,203973	Sum	281,5931	59,53284
Std. Dev.	1,482903	0,986367	Sum Sq. Dev	76,96505	34,05220
Skewness	-0,240267	-0,165263	Observations	36	36

Source: Prepared by the researchers based on the outputs of the Eviews10 program.

It is evident from the table above that the mean of the study variables differs from their median, indicating that their curves are asymmetric. This is also confirmed by their skewness coefficients, which differ from zero. Since the skewness coefficient of the logarithm of inflation and the logarithm of money supply had negative values, their curves are skewed to the left. It also appears that the values of the kurtosis coefficients for the money supply are less than three, which means that their curves are flattened, whereas the logarithm of inflation had a kurtosis coefficient value of three, thus their curves are peaked upwards.

As for the critical probabilities for the Jarque-Bera statistics for both variables, they were greater than the significance level of 5%, which indicates that the two variables follow a normal distribution. The following table presents the correlation matrix between the study variables, which may allow predicting the nature of the relationship between these two variables:

Table (02). The correlation matrix for the study variables at the level

	LM2	LINF
LM2	1,0000	-0,4599
LINF	-0,4599	1,0000

Source: Prepared by the researchers based on the outputs of the Eviews10 program.

From the table above, the correlation matrix for money supply and inflation is shown, and it is clear from the table that there is a weak inverse correlation between money supply and inflation, where the correlation coefficient recorded is -0.45.

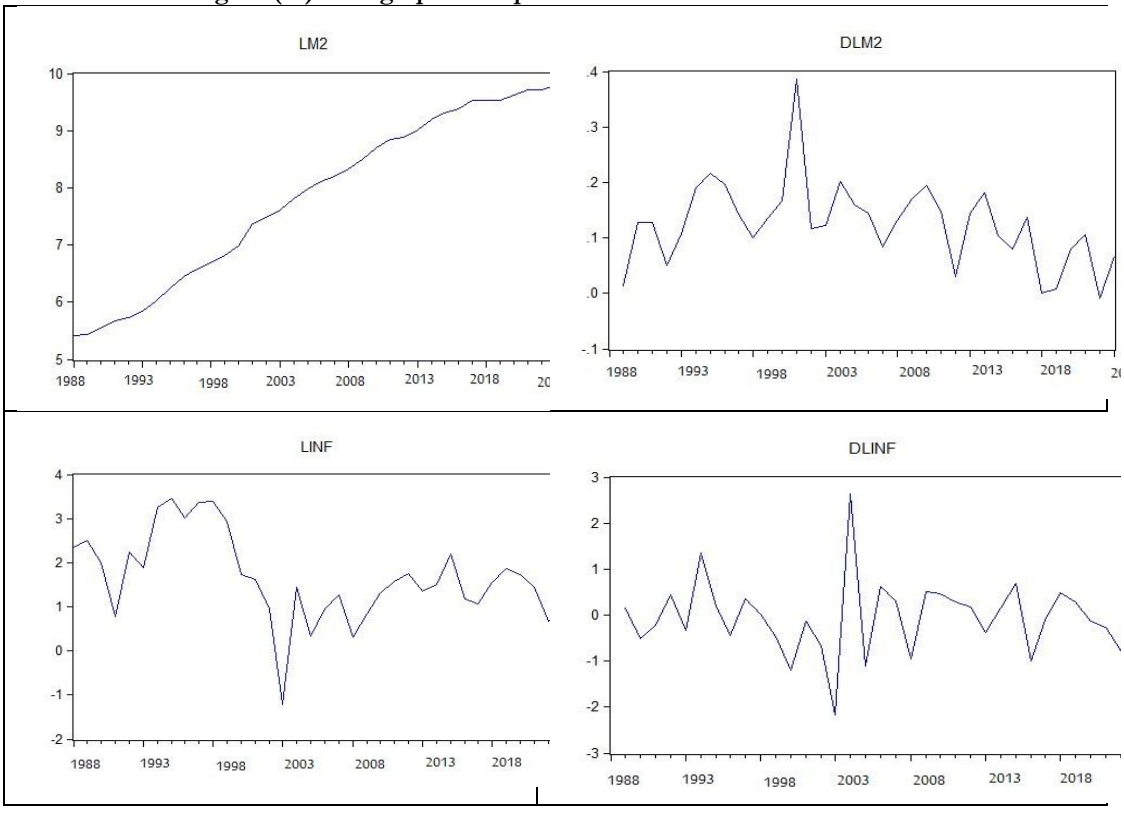
Stability study of study variables

Given the critical importance of the stability property and the misleading and unrealistic results that can arise from the instability of time series, attention should be focused on testing the extent to which the study variables satisfy the stability property and ensuring the proper handling of the study model with high confidence levels.

Stability study of time series using graph:

The following chart shows the development of the studied economic variables:

Figure (01). The graphical representations of the model variables



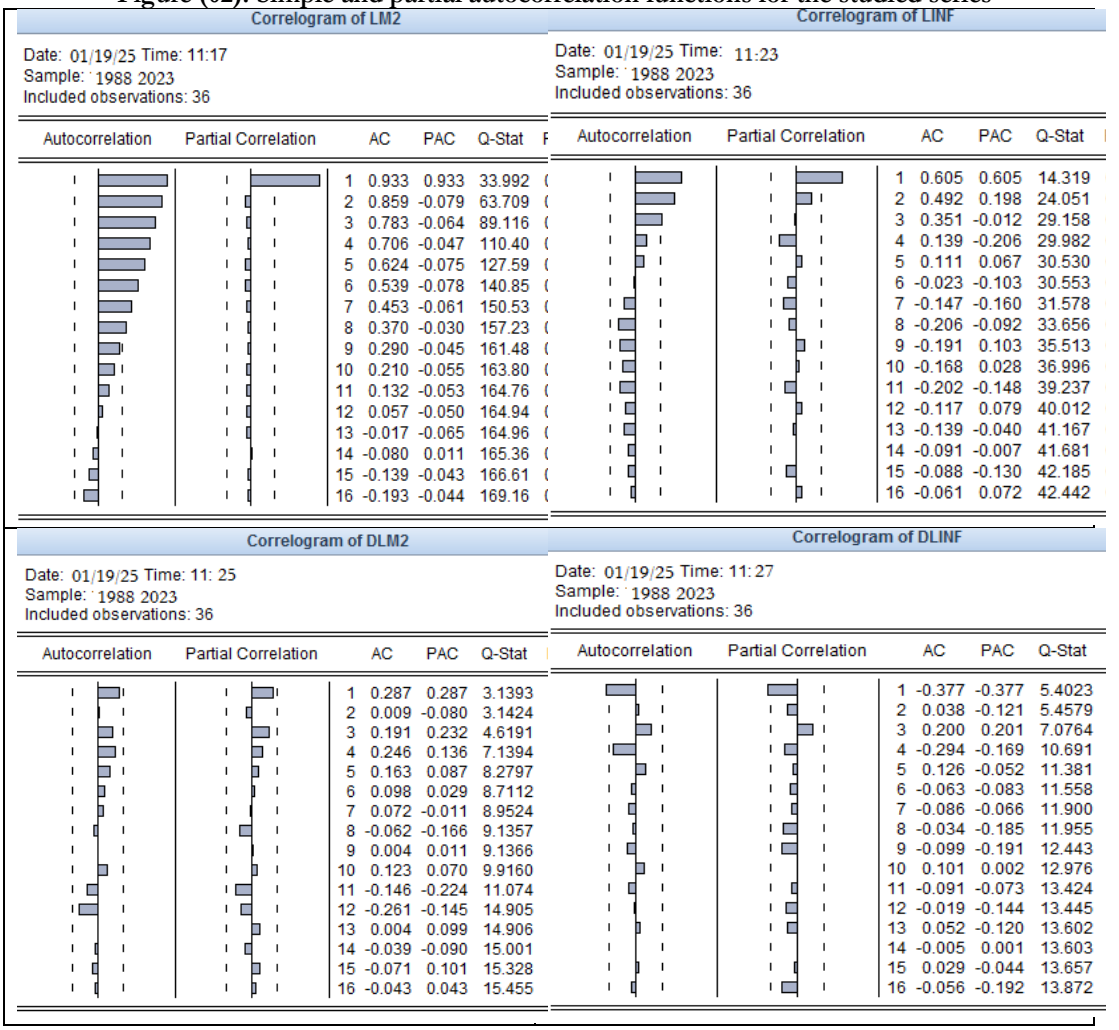
Source: Prepared by the researchers based on the outputs of the Eviews10 program.

It initially appears from the above figure, which shows the curves of the development of the study variables over the period from 1988 to 2023, that there is a general trend in all these time series, indicating that they are not stable at that level but become stable after taking first differences. In order to support this result, it is necessary to use other tests such as the autocorrelation function and unit root tests. In this regard, the Phillips-Perron (PP) test and the Augmented Dickey-Fuller (ADF) test will be conducted.

Test of the significance of the autoregressive coefficients for the series under study

The autocorrelation function (column AC) and the partial autocorrelation function (column PCA) for the time series under study are as follows:

Figure (02). Simple and partial autocorrelation functions for the studied series



Correlogram of LM2

Date: 01/19/25 Time: 11:17
Sample: 1988 2023
Included observations: 36

		AC	PAC	Q-Stat
1		0.933	0.933	33.992
2		0.859	-0.079	63.709
3		0.783	-0.064	89.116
4		0.706	-0.047	110.40
5		0.624	-0.075	127.59
6		0.539	-0.078	140.85
7		0.453	-0.061	150.53
8		0.370	-0.030	157.23
9		0.290	-0.045	161.48
10		0.210	-0.055	163.80
11		0.132	-0.053	164.76
12		0.057	-0.050	164.94
13		-0.017	-0.065	164.96
14		-0.080	0.011	165.36
15		-0.139	-0.043	166.61
16		-0.193	-0.044	169.16

Correlogram of LINF

Date: 01/19/25 Time: 11:23
Sample: 1988 2023
Included observations: 36

		AC	PAC	Q-Stat
1		0.605	0.605	14.319
2		0.492	0.198	24.051
3		0.351	-0.012	29.158
4		0.139	-0.206	29.982
5		0.111	0.067	30.530
6		-0.023	-0.103	30.553
7		-0.147	-0.160	31.578
8		-0.206	-0.092	33.656
9		-0.191	0.103	35.513
10		-0.168	0.028	36.996
11		-0.202	-0.148	39.237
12		-0.117	0.079	40.012
13		-0.139	-0.040	41.167
14		-0.091	-0.007	41.681
15		-0.088	-0.130	42.185
16		-0.061	0.072	42.442

Correlogram of DLM2

Date: 01/19/25 Time: 11: 25
Sample: 1988 2023
Included observations: 36

		AC	PAC	Q-Stat
1		0.287	0.287	3.1393
2		0.009	-0.080	3.1424
3		0.191	0.232	4.6191
4		0.246	0.136	7.1394
5		0.163	0.087	8.2797
6		0.098	0.029	8.7112
7		0.072	-0.011	8.9524
8		-0.062	-0.166	9.1357
9		0.004	0.011	9.1366
10		0.123	0.070	9.9160
11		-0.146	-0.224	11.074
12		-0.261	-0.145	14.905
13		0.004	0.099	14.906
14		-0.039	-0.090	15.001
15		-0.071	0.101	15.328
16		-0.043	0.043	15.455

Correlogram of DLINF

Date: 01/19/25 Time: 11:27
Sample: 1988 2023
Included observations: 36

		AC	PAC	Q-Stat
1		-0.377	-0.377	5.4023
2		0.038	-0.121	5.4579
3		0.200	0.201	7.0764
4		-0.294	-0.169	10.691
5		0.126	-0.052	11.381
6		-0.063	-0.083	11.558
7		-0.086	-0.066	11.900
8		-0.034	-0.185	11.955
9		-0.099	-0.191	12.443
10		0.101	0.002	12.976
11		-0.091	-0.073	13.424
12		-0.019	-0.144	13.445
13		0.052	-0.120	13.602
14		-0.005	0.001	13.603
15		0.029	-0.044	13.657
16		-0.056	-0.192	13.872

Source: Prepared by the researchers based on the outputs of.Eviews10

It is clear from the graphical representations of the autocorrelation function of the original time series that the value of the Q-Stat statistic at the lag (K=16) exceeds the critical value $\chi^2_{0.05,16} = 26.30$; therefore, the null hypothesis stating that all autocorrelation coefficients are equal to zero is rejected (the p-value for this test for all these series is also less than 0.05, hence the null hypothesis is rejected). This indicates that the series under study are unstable.

As evidenced by the graphical representations of the autocorrelation function for the time series at first differences, the value of the Q-Stat statistic at lag (K=16) is less than the critical value, and thus the null hypothesis stating that all autocorrelation coefficients are equal to zero is accepted (the p-value for this test is also greater than 0.05 for all these series, therefore the null hypothesis is accepted). This indicates that the series under study are stationary at the first difference.

Unit root test for the series under study

The models for the ADF and PP tests were estimated using Eviews10, where the appropriate lag lengths were determined based on the Akaike Information Criterion, Schwarz Criterion, and Hannan-Quinn Criterion, which some experts consider to be the best criteria in the case of small samples. The results of the tests are presented in the table below.

Table (03). Results of the unit root test for the series under study at the level

Study chains	Delay degree	ADF			PP			The decision
		With a fixed presence and a general direction	With a fixed presence	The lack of fixed and a general direction	With a fixed presence and a general direction	With a fixed presence	The lack of fixed and a general direction	
LM2	0	0,58 [-3,54]	-1,79 [-2,94]	8,28 [-1,95]	0,58 [-3,54]	-1,65 [-2,94]	5,35 [-1,95]	DS
LINF	1	-2,14 [-3,54]	-1,93 [-2,94]	-1,31 [-1,95]	-2,99 [-3,54]	-2,64 [-2,94]	-1,42 [-1,95]	DS

Source: Prepared by the researchers based on the outputs of the Eviews10 program.

It is clear from the above table that most of the calculated statistical values for the ADF test and the PP test for all variables are greater than the tabulated statistical values in the models at the 5% significance level, indicating the acceptance of the null hypothesis which states that there is a unit root in all study variables, meaning that all series are non-stationary at the level and of type DS. Therefore, we proceed directly to applying first differencing to make them stable.

Table (04). Results of the Unit Root Test for the series under study at the first difference

Study chains	Delay degree	ADF			PP			Degree of integration
		With a fixed presence and a general direction	With a fixed presence	The lack of fixed and a general direction	With a fixed presence and a general direction	With a fixed presence	The lack of fixed and a general direction	
DLM2	0	-4,98 [-3,54]	-4,30 [-2,94]	-1,97 [-1,95]	-4,98 [-3,54]	-4,30 [-2,94]	-1,98 [-1,95]	I(1)
DLINF	1	-5,01 [-3,54]	-5,10 [-2,94]	-5,15 [-1,95]	-8,33 [-3,54]	-8,47 [-2,94]	-8,55 [-1,95]	I(1)

Source: Prepared by the researchers based on the outputs of the Eviews10 program.

It is clear from the table above that the calculated statistical values for the ADF test and the PP test at the first difference for all variables are smaller than the tabulated statistical values in the models at the 5% and 10% significance levels, which means rejecting the null hypothesis that states there is a unit root in these variables. In other words, it can be said that all study variables stabilize at their first difference.
Through the results of the Dickey-Fuller ADF test and the Phillips-Perron PP test, the key findings can be summarized in the following table:

Table (05). ADF Dickey-Fuller Test and Phillips–Perron PP Test

The series	LINF	LM2
Vehicle Series	DS	DS
Degree of integration	I(1)	I(1)

Source: Prepared by the researchers based on the outputs of the Eviews10 program.

Based on the results of the table above and the stability results of the time series, which showed that all study variables are integrated of order one I(1), this allows for the possibility of a long-term equilibrium relationship between the variables included in the model.

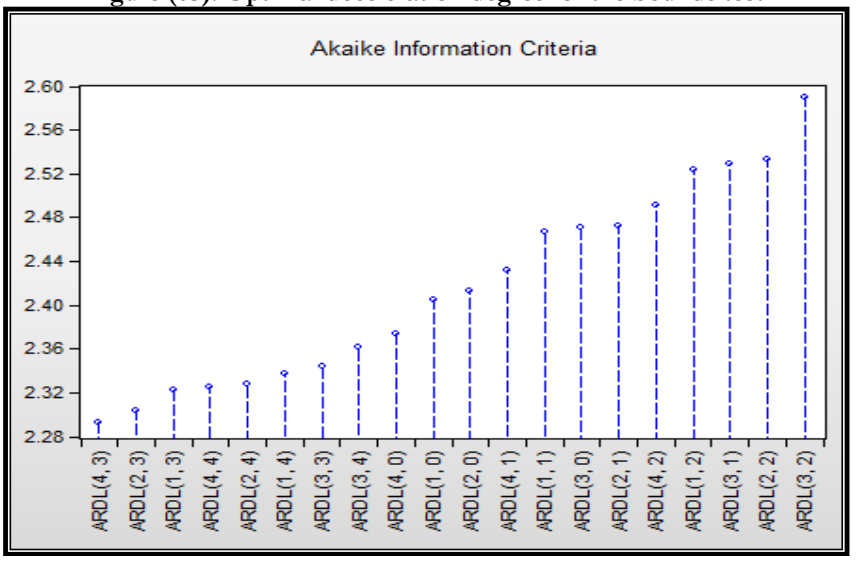
Joint integration test between the variables of inflation and money supply

After studying the stability of the series under investigation, it was found that the LM2 and LINF series are unstable at level but became stable after taking first differences. In this case, we move to test for cointegration according to the Autoregressive Distributed Lag (ARDL) framework, as developed by Pesaran et al. (2001), which allows for testing the existence of cointegration regardless of the order of integration of the time series for the study variables, provided that it does not exceed the first order.

Finding the degree of delay

The transition to the second phase will involve relying on the threshold test to examine the possibility of joint integration relationships between these two variables. However, before that, it is necessary to determine the optimal number of lags to include in the model due to the sensitivity of this test to them. For this purpose, we will rely on the Akaike Information Criterion (AIC) since it provides better results in the case of small samples. The following figure illustrates the optimal number of lags:

Figure (03). Optimal deceleration degree for the bounds test



Source: Prepared by the researchers based on the outputs of the Eviews10 program.

From the above figure, we can choose to identify the best lagged model at ARDL(4,3) which corresponds to the lowest value of the Akaike Information Criterion (AIC), that is, four lags for (LINF) and three lags for (LM2).

Model estimation

The results of the ARDL (4.3) model estimation are shown in the following table:

Table (06).ARDL model estimation (4.3)

Dependent Variable: LINF
Method: ARDL
Date: 01/19/25 Time: 15:22
Sample (adjusted): 1988 2023
Included observations: 32 after adjustments
Maximum dependent lags: 4 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (4 lags, automatic): LM2
Fixed regressors: C
Number of models evalulated: 20
Selected Model: ARDL(4, 3)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LINF(-1)	0.355293	0.159501	2.227525	0.0360
LINF(-2)	0.348442	0.177686	1.961003	0.0621
LINF(-3)	0.000373	0.177999	0.002096	0.9983
LINF(-4)	-0.271610	0.163588	-1.660329	0.1104
LM2	-1.807904	1.901987	-0.950534	0.3517
LM2(-1)	2.201625	2.970476	0.741169	0.4661
LM2(-2)	-5.761943	3.013032	-1.912341	0.0684
LM2(-3)	5.012526	1.914869	2.617687	0.0154
C	4.578750	1.355820	3.377107	0.0026

R-squared	0.668594	Mean dependent var	1.621393
Adjusted R-squared	0.553322	S.D. dependent var	1.014388
S.E. of regression	0.677955	Akaike info criterion	2.292788
Sum squared resid	10.57134	Schwarz criterion	2.705026
Log likelihood	-27.68461	Hannan-Quinn criter.	2.429433
F-statistic	5.800155	Durbin-Watson stat	1.867738
Prob(F-statistic)	0.000419		

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

Source: Prepared by the researchers based on the outputs of the Eviews10 program.

It is initially clear to us that the model as a whole is statistically acceptable based on the Fisher test, in addition to the corrected coefficient of determination, which amounted to 66.85%. This indicates that the explanatory variables (previous period inflation rate, money supply) are responsible for 66.85% of the variations occurring in the dependent variable (inflation rate) due to the changes that occur in them, while the remainder represents the effect of other (random) variables not included in the model, and this percentage is considered indicative of the model's validity.

Results of the binomial test

After determining the optimal delay degree for my ARDL models, we proceed to estimate the UECM model and then test for the existence of a cointegration relationship according to the bounds testing methodology and by applying the optimal lag periods. The models to be estimated and the relationship to be tested based on them in the short and long term, when applying the optimal lag intervals, yield the results summarized in the following table:

Table (07). Results of the binomial method test

ARDL Bounds Test
Date: 01/19/25 Time: 15:25
Sample: 1988 2023
Included observations: 32
Null Hypothesis: No long-run relationships exist

Test Statistic	Value	k
F-statistic	6.458543	1

Critical Value Bounds

Significance	I0 Bound	I1 Bound
10%	4.04	4.78
5%	4.94	5.73
2.5%	5.77	6.68
1%	6.84	7.84

Source: Prepared by the researchers based on the outputs of the Eviews10 program.

After estimating the model and calculating the F statistic, the latter is compared to the tabulated values adjusted according to NARAYAN, 2004 for the case of small samples (80 observations or less), considering that the critical values prepared according to PASARAN & AL, 2001 are based on large sample sizes and cannot be used in the case of small samples.
From the table above, we notice that the F statistic value for the model is greater than the proposed upper threshold value by Narayan at different significance levels of 5% and 10%. Therefore, we reject the null hypothesis and accept the alternative hypothesis which states that there is a cointegration relationship between the money supply and the inflation rate in Algeria. Consequently, we will proceed to measure the long-term relationship between these two variables.

Assessing the study models according to the ARDL methodology and their suitability quality
We address the Granger causality test between the study variables, which include the stationary variables, then we discuss estimating the models for each variable of the study according to the ARDL methodology, before moving on to test the validity of the model through a series of tests.

Causality test between variables
In order to investigate the direction of causal relationships between the money supply and other study variables, we will rely on the Granger test, which is based on the original series, thus avoiding the possibility of incorrectly determining the degree of integration of the series, which may lead to spurious results.
The results of the causality test between the variables in Algeria using the Granger method are shown in the following table:

Table (08). Results of the causality test between variables

ARDL Cointegrating And Long Run Form
Dependent Variable: LINF
Selected Model: ARDL(4, 3)
Date: 01/20/25 Time:12:24
Sample: 1988 2023
Included observations: 32

Cointegrating Form

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LINF(-1))	-0.077206	0.188303	-0.410009	0.6856
D(LINF(-2))	0.271236	0.184708	1.468460	0.1555
D(LINF(-3))	0.271610	0.163588	1.660329	0.1104
D(LM2)	-1.807904	1.901987	-0.950534	0.3517
D(LM2(-1))	5.761943	3.013032	1.912341	0.0684
D(LM2(-2))	-5.012526	1.914869	-2.617687	0.0154
CointEq(-1)	-0.567501	0.175058	-3.241790	0.0036

Cointeq = LINF - (0.6268*LM2 + 8.0683)

Source: Prepared by the researchers based on the outputs of the Eviews10 program.

- **The first hypothesis test:** We notice that the probability corresponding to the Fisher statistic is 0.1793, which is greater than the commonly accepted significance levels of 5% and 10%. This means that the inflation rate does not cause the money supply during the study period in Algeria.
- **The second hypothesis test**: We notice that the corresponding probability for the Fisher statistic is 0.7834, which is greater than the commonly accepted significance levels of 5% and 10%. This means that the money supply does not cause the inflation rate during the study period in Algeria.

Estimation of the inflation model according to the ARDL methodology

After the Bounds test results indicated a cointegrating relationship between the inflation rate and the money supply, we will now proceed to estimate the Autoregressive Distributed Lag (ARDL) model, which represents the short-term relationship and includes the long-term relationship between the two variables. Then we will try to analyze this model and test its validity.

After estimating the long-term relationships for the inflation rate model and the money supply variable, and relying on the 10Eviews program, the results are as shown in the following table:

Table (09). Results of estimating the relationship in the long run

Long Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LM2	0.626775	0.211493	-2.963567	0.0070
C	8.068267	2.274988	3.546510	0.0017

Source: Prepared by the researchers based on the outputs of the Eviews10 program.

From the table above, we notice the following**:**

-The estimated parameter value for the constant term indicates that when the values of the independent variable are zero, the inflation rate is at 8.06. This result is consistent with economic theory**.**

- There is a positive effect of the money supply on the inflation rate in the long run, which is statistically significant at the 5% significance level, as (P=0.00<0.05). This indicates that for every one unit increase in the money supply, the inflation rate will increase by 0.626 units in the long run. This result aligns with economic theory, as the authorities' tendency to adopt an expansionary monetary policy, i.e., increasing the money supply, leads to an increase in aggregate demand. In other words, any increase occurring in one or some or all components of aggregate demand, such as an increase in public or private investment or an increase in net foreign trade, for example, will lead to a rise in the general price level and, consequently, inflation.

Short-term model estimation

After estimating the error correction model for the inflation rate as a dependent variable and money supply as an independent variable, the results were as shown in the following table:

Table (10). Results of short-term model estimation.

ARDL Cointegrating And Long Run Form
Dependent Variable: LINF
Selected Model: ARDL(4, 3)
Date: 01/20/25 Time: 12:24
Sample: 1988 2023
Included observations: 32

Cointegrating Form

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LINF(-1))	-0.077206	0.188303	-0.410009	0.6856
D(LINF(-2))	0.271236	0.184708	1.468460	0.1555
D(LINF(-3))	0.271610	0.163588	1.660329	0.1104
D(LM2)	-1.807904	1.901987	-0.950534	0.3517
D(LM2(-1))	5.761943	3.013032	1.912341	0.0684
D(LM2(-2))	-5.012526	1.914869	-2.617687	0.0154
CointEq(-1)	-0.567501	0.175058	-3.241790	0.0036

Cointeq = LINF - (0.6268*LM2 + 8.0683)

Source: Prepared by the researchers based on the outputs of the Eviews10 program.

The error correction term coefficient represents a pull towards long-term equilibrium, and from the table above, we notice that it has a negative sign and is statistically significant at the 5% level and even at the 1% level, as (P=0.0036<0.01). In the error correction model, this confirms the existence of a long-term equilibrium relationship, where the coefficient value in the case of the inflation rate as a dependent variable is -0.567501, a high value indicating that the return of the inflation rate to its equilibrium level after being subjected to a shock requires approximately (1/0.567501=1.76), or nearly two years.

Testing the quality and validity of the model related to the inflation rate

At this stage, we will review a set of tests that measure the quality and suitability of the model related to the inflation rate.

Serial correlation test of errors:

In order to ensure that there is no autocorrelation of second-order errors in the estimated model, the Breusch-Godfrey LM test was used, and the results of this test are shown in the table below:

Table (11). Sequential correlation test for errors in the model

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	1.173247	Prob. F(2,21)	0.3288
Obs*R-squared	3.216234	Prob. Chi-Square(2)	0.2003

Source: Prepared by the researchers based on the outputs of the Eviews10 program.

From the results of the table above, it is clear that the model does not suffer from the issue of autocorrelation of errors, as the hypothesis suggesting the presence of autocorrelation of errors was rejected. This is because the tabulated value (F=3.467) is greater than the calculated value, which equals 1.173247, and the p-value for the F-statistic, equal to 0.328, exceeds the significance level of 5%.

Test of Homogeneity of Variance

We used the ARCH test, which tests for homogeneity of variance, and its results are shown in the following table:

Table (12). Results of the ARCH test

Heteroskedasticity Test: ARCH			
F-statistic	0.368445	Prob. F(1,29)	0.5486
Obs*R-squared	0.388914	Prob. Chi-Square(1)	0.5329

Source: Prepared by the researchers based on the outputs of the Eviews10 program.

We observe from the table above that the p-value is 0.54, which is greater than the significance level of 5%, and thus we accept the null hypothesis which states that the variances are homogeneous.

White Noise Disturbances test

The LB test shows the white noise test for the residuals (stability of the residuals), and the results of this test are presented in the following table.

Table (13). Results of the LB test for the series of residues

Correlogram of Residuals

Date: 01/20/25 Time:: 12:36
Sample: 1988 2023
Included observations: 32
Q-statistic probabilities adjusted for 4 dynamic regressors

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob*
		1	0.065	0.065	0.1466	0.702
		2	-0.167	-0.172	1.1560	0.561
		3	-0.013	0.011	1.1625	0.762
		4	-0.046	-0.077	1.2460	0.870
		5	-0.035	-0.027	1.2941	0.936
		6	-0.011	-0.029	1.2991	0.972
		7	-0.023	-0.033	1.3226	0.988
		8	0.047	0.042	1.4208	0.994
		9	-0.027	-0.050	1.4554	0.997
		10	-0.298	-0.293	5.8511	0.828
		11	-0.210	-0.214	8.1284	0.702
		12	-0.128	-0.259	9.0155	0.702
		13	0.063	-0.043	9.2406	0.755
		14	0.147	0.023	10.544	0.721
		15	0.007	-0.057	10.547	0.784
		16	-0.097	-0.165	11.185	0.798

*Probabilities may not be valid for this equation specification.

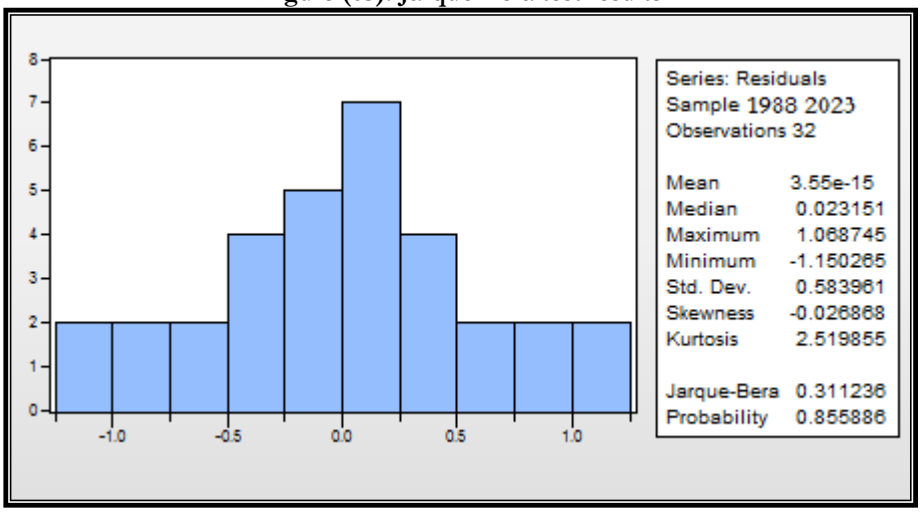
Source: Prepared by the researchers based on the outputs of the Eviews10 program.

From the LB test, we observe that the last p-value (0.798) is greater than the significance level of 5%, thus we accept the null hypothesis H_0, which states that all autocorrelation coefficients equal zero. In other words, the residual series is a stationary series and represents white noise.

Normal distribution test

In order to ensure that the residual series follows a normal distribution, we use the Jarque-Bera test, and the results of this test are illustrated in the following figure:

Figure (03). Jarque-Bera test results



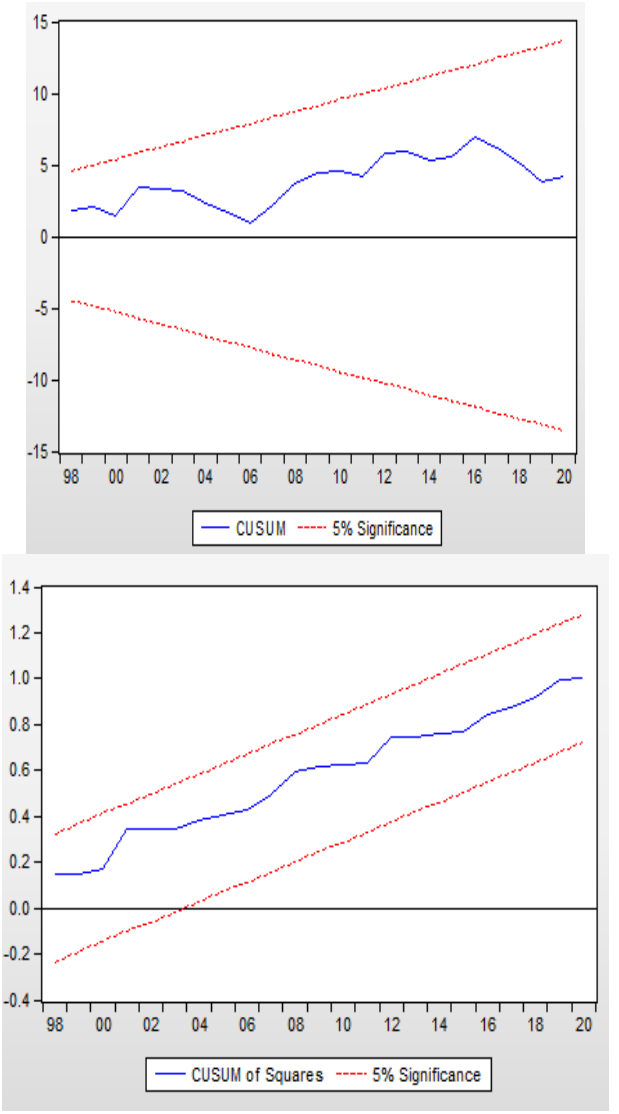
Source: Prepared by the researchers based on the outputs of the Eviews10 program.

The results indicate that the value of the test is (J-B = 0.31), which is less than the scheduled value of 5.99. Therefore, we accept the null hypothesis which states that the residuals of the estimated model follow a normal distribution, and we can say that the series of residuals follows a normal distribution.

Cumulative sum test for the remainder and cumulative sum of squares of the remainder

To test the stability of the model and to ensure that the variables used in this study are free of any structural changes over time, we use the cumulative sum of residuals test and the cumulative sum of squared residuals test. The results of the test are illustrated in the following figure:

Figure (04). The result of the (CUSUM) and (CUSUMSQ) test



Source: Prepared by the researchers based on the outputs of the Eviews10 program.

From the shape above, we observe that the model parameters in both the cumulative residual sum and the cumulative squared residual sum are represented by a mean line that lies within the boundaries of the critical region, indicating structural stability between the long-term and short-term results.

6. The conclusion

In this research, we addressed the necessity for economic institutions to develop a strategy to monitor changes in the inflation rate, through its relationship with the money supply. Given that the money supply is one of the most important factors that affect and determine inflation, we tried, through various aspects of the research, to demonstrate the extent to which the money supply can influence inflation, knowing that changes in its size affect the internal and external balances of economic institutions .

Through our study of the impact of the money supply on inflation, we focused on the research problem: 'To what extent can economic institutions determine the level of inflation based on its relationship with the money supply?' In light of what was presented in both the theoretical, analytical, and econometric aspects, we were able to observe a set of results as outlined in the following points:

- Inflation may accelerate instability and increase the likelihood of business closures in less resilient economies.
- Among the effects of inflation on Economic enterprise we find: rising raw materials costs, higher interest rates and rising (or falling) unemployment and the problem of how to raise their own prices**.**
- When Inflation occurs, prices rise and the purchasing power of money goes down and the goods and services become more expensive and the value of people's incomes diminish. But in times of accelerating inflation, demand for any given product , especially essential goods, might suddenly spike because customers worry that inflation will continue to rise and decide to stock up before their purchasing power drops further**.**
- Economic enterprise have several options to cope with inflation, such as raising prices, cutting costs, reevaluating business practices.
- There is a positive effect of money supply on the inflation rate in the long term, and for every one-unit increase in money supply, the inflation rate will rise by 0.626 units.
- The existence of a long-term equilibrium relationship between the money supply and the inflation rate, and the return of the inflation rate to its equilibrium level after being subjected to a shock, requires around two years.
- The money supply is determined by the monetary authority represented by the central bank based on several factors, including the state of economic activity, the inflation rate, and the growth rate. However, the authority is considered constrained, limited, and not absolute. The central bank must provide the necessary backing for any new currency issued.
- The issuance of currency that is not backed by a physical asset encourages demand due to the increase in the supply of money circulating in the market. If production remains constant during this time, it will inevitably lead to financial inflation, which causes confusion in implementing development projects due to the difficulty in determining their future costs. Consequently, this results in social injustice for those with fixed and semi-fixed incomes, such as employees, pensioners, and bondholders, whose cash incomes lag behind rising prices, while those with variable incomes, such as traders, businessmen, and professionals, benefit.
- An increase in the money supply by a rate greater than the increase in real national output generates excess demand that pushes prices upward. This occurs through an increase in the total demand for goods and services in the economy at a rate that exceeds the increase in the quantity of goods and services offered. In other words, there is a direct relationship between the money supply and both GDP and inflation.
- The rise in inflation affects the balance of payments. The inflationary increase in government spending (and thus cash incomes) leads to an increase in demand not only for locally produced goods but also for imported ones. Furthermore, inflation tends to raise the production costs of exported goods, which leads to an increase in their prices, weakening their competitive position in foreign markets and consequently reducing the trade balance.
- Inflation rates are closely linked to oil prices, as an increase in the latter leads to an increase in public spending through the consumption channel, which is accompanied by an increase in aggregate demand for imported goods and services. Therefore, any reaction towards reducing imports will lead to an increase in the inflation rate, which complicates the implementation of monetary policy.
- The reasons for inflation in Algeria are structural and institutional, not just monetary, especially since it has witnessed monetary, financial, and structural inflation. The cause of monetary inflation was the increased supply of money due to the growth of external assets, which became the most prominent contributor to rising inflation rates. On the other hand, imported inflation is a result of increased aggregate demand, especially for imported products.

7. The suggestions

In light of these results, a number of recommendations can be presented as follows:

1 -Absorbing the monetary mass not participating in the economy by recognizing and regulating informal activities ;

2 -The necessity of reforming the banking system, freeing decisions of public banks, activating the role of the stock exchange, and creating a developed financial market that allows monetary authorities to implement quantitative tools of monetary policy and create a suitable market for monetary policy to operate efficiently and effectively ;

3 -Modernizing the tax system to contribute to expanding the tax base and reducing dependence on oil revenues ;

4 -The necessity of strengthening the role of the central bank and enhancing its independence by distancing it from political pressures ;

5- Modernizing both public administration and the financial sector to obtain accurate information that allows the monetary authority to formulate monetary policy based on correct information, and helps to adopt a transparent and credible monetary policy based on real data, to ensure its success in the short and medium term.

References

[1] Gregory Mankiw, Principles Of Economics, Seme Edition, Cengage Learning Education, Usa, 2018.

[2] David G. Pierce, Peter J. Tysome, Monetary Economics Theories, Evidence And Policy, 2éme Édition, Butterworth Education, Great Britain, 1985.

[3] Zahira Bouhassoun Bedjaoui, La Relation Monnaie-Inflation Dans Le Contexte De L'économie Algérienne, Thèse Doctorat En En Sciences Economiques, Spécialité: Gestion, Université Aboubakr Belkaïd- Tlemcen, 2014/2013..

[4] Thamer Alwan Al-Musleh, Knowledge of Micro and Macro Economics, 1st edition, Dar Al-Ayyam for Publishing and Distribution, Jordan, 2015.

[5] Abdelmajid Qadi, Introduction to Macroeconomic Policies: An Analytical Evaluative Study, 4th edition, University Publications Office, Algeria, 2017..

[6] William A. Mceachern, Macroeconomics: A Contemporary Introduction, 8éme Édition, South Wistern Édition, Usa, 2009..

[7] Karl E. Case, Ray C. Fair, Sharon M. Oster, Principles Of Economics, 10éme Edition, Pearson Education, Usa, 2012..

[8] Bakhti Ibrahim, Hattahat Al-Saeed, A Predictive Study of the Inflation Phenomenon in Algeria during the period (2002-2020), an article submitted to the Journal of Financial, Accounting, and Administrative Studies, Volume: 07, Issue: 02, University of Arab Ben Mehidi Um El Bouaghi, Algeria, 2020.

[9] Abdel Mottalab Abdel Hamid, Monetary Policy and Independence of the Central Bank, 1st edition, University Publishing House, Egypt, 2013.

[10] Ben Youssef Nawa, The Impact of Inflation on Macroeconomic Variables: An Empirical Study of the Case of Algeria during the Period 1979-2012, Unpublished Doctoral Thesis, Specialization in Applied Economics, Mohamed Khodira University, Biskra, Algeria, 2015/2016.

[11] Michael L.Ross, The Oil Curse: How Petroleum Wealth Shapes the Development of Nations, Princeton University Press, the United Kingdom, 2012.

Study Variables								
INF	**M2**	**the years**	**INF**	**M2**	**the years**	**INF**	**M2**	**the years**
8,89	11015,1	2012	0,3	2022,5	2000	5,91	292,96	1988
3,26	11941,5	2013	4,2	2473,5	2001	9,3	308,14	1989
2,92	13686,7	2014	1,4	2901,5	2002	6,65	343	1990
4,78	13704,5	2015	2,6	3354,4	2003	25,87	415,2	1991
6,4	13816,3	2016	3,54	3644,3	2004	31,68	515,9	1992
5,59	14974,6	2017	1,38	4157,6	2005	20,52	627,4	1993
4,27	16636,7	2018	2,31	4933,7	2006	29,06	723,5	1994
1,95	16506,6	2019	3,68	5994,6	2007	29,78	799,5	1995
2,42	17659,6	2020	4,86	6955,9	2008	18,69	915	1996
7,23	20080.0	2021	5,74	7173,1	2009	5,7	1081,5	1997
9,27	22960.0	2022	3,91	8280,7	2010	5	1592,5	1998
9,32	24330.0	2023	4,52	9929,2	2011	2,6	1789,04	1999

Source: Prepared by the researchers based on:

Bank of Algeria, Annual Report on Economic and Monetary Development for the year 2021, December 2022, pp. 101-112.

Bank of Algeria, Annual Report on Economic and Monetary Developments for 2021, December 2022, pp. 101-112.

Bank of Algeria, Annual Report on Economic and Monetary Developments for 2020, December 2021, pp. 147-158.

Bank of Algeria, Annual Report on Economic and Monetary Developments for 2019, December 2020, pp. 150-160.

Bank of Algeria, Annual Report on Economic and Monetary Developments for 2018, December 2019, pp. 109-160.

Bank of Algeria, Annual Report on Economic and Monetary Developments for 2017, July 2018, pp. 106-116.

Bank of Algeria, Annual Report on Economic and Monetary Developments for 2016, September 2017, pp. 145-156.

Bank of Algeria, Annual Report on Economic and Monetary Developments for 2015, November 2016, pp. 153-163.

Bank of Algeria, Annual Report on Economic and Monetary Developments for 2013, November 2014, pp. 213-228.

Bank of Algeria, Annual Report on Economic and Monetary Developments for 2012, November 2013, pp. 237-248.

Bank of Algeria, Annual Report on Economic and Monetary Developments for 2011, October 2012, pp. 213-223.

Bank of Algeria, Annual Report on Economic and Monetary Developments for 2010, July 2011, pp. 203-214.

Bank of Algeria, Annual Report on Economic and Monetary Development for the year 2008, September 2009, pp. 231-242.

Banque d'Algérie, Evolution Economique et monétaire en Algérie, rapport 2014, juillel 2015 , p-p 149-159.

Banque d'Algérie, Evolution Economique et monétaire en Algérie, rapport 2009, juillel 2010, p-p 201-213.

Banque d'Algérie, Evolution Economique et monétaire en Algérie, rapport 2007, juillet 2008, p-p 188-199.

Banque d'Algérie, Evolution Economique et monétaire en Algérie, rapport 2006, juin 2007, p-p 158-169.

Banque d'Algérie, Evolution Economique et monétaire en Algérie, rapport 2005, Avril 2006, p-p 174-185.
Banque d'Algérie, Evolution Economique et monétaire en Algérie, rapport 2004, juillel 2005, p-p 161-172.
Banque d'Algérie, Evolution Economique et monétaire en Algérie, rapport 2003, 2004, p-p 160-172.
Banque d'Algérie, Evolution Economique et monétaire en Algérie, rapport 2002, 2003, p-p 158-170.
Banque d'Algérie, BULLETIN STATISIQUE DELA BANQUE D'ALGERIE, SERIES RETROSPECTIVES, STATISTIQUES MONETAIRES PAIEMENTS, 1964 - 2011, juin 2012, p - p: 14, 28, 29, 47, 48 .
World Bank statistics, available at the link:
http://data.albankaldawli.org/country/algeria?view=chart