Management & Economics Research Journal
ISSN 2710-8856
ISSN 2676-184X
University of Djelfa - Algeria

Vol. 05 No. 03 (2023). P. 630/646.

The Effect of Oil Prices Fluctuation on Inflation in Algeria

-Using MIDAS Regressions-

Ben Mouaffek ZERROUK *(1)
z.benmouffek@univ-djelfa.dz
[1]*Professor Lecturer B, Faculty of Economic Sciences, Commerce and Management Science, University of Djelfa, Member of the laboratory L.P.D.R.S (Djelfa -Algeria).*

Khallout MANAL (2)
✉ manal.khallout@univ-batna.dz
[2]*PHD-Student, of Economic Sciences, Commercial and Management sciences, University of Batna 1, Member of the laboratory LEEM (Batna-Algeria).*

KESRI Mohamed Adel [3]
✉m.kesri@univ-djelfa.dz
4Professor Lecturer A, Faculty of Economic Sciences, Commerce and Management Science, University of Djelfa, Member of the laboratory MQEMADD (Djelfa -Algeria).

Djorfi ZAKARIA [4]
✉ djorfi.zakaria@cu-tipaza.dz
[3]*Professor Lecturer B, Institute of Economic Sciences, Business and Management Science, University Center of Tipaza (Algeria).*

Received: 05/07/2023 Accepted :03/09/2023

The purpose of this study is to contribute to the literature by studying the effects of sudden changes in crude oil prices on inflation in Algeria. Since an inflation-targeting regime is being carried out by the Central Bank of Algeria, the determination of such effects is becoming more important. Therefore empirical evidence in this paper proposed MIDAS regressions resorting to Almon Lag Polynomials to determine the nature and strength of the relationship that binds the Oil prices fluctuation to the rate of inflation in Algeria during the period 2010-2022, using the Eviews program 12.

The result of the empirical analysis reveals the positive impact of the frequency of the high Oil prices (monthly) on the frequency of the low Inflation Rate (quarterly) in Algeria during the period 2010-2022, which concluded that there is an immediate positive effect for Oil prices in the Inflation variable, whereas it appears in the larger way after 04 months, also the findings point to predict of inflation until the second quarter of 2023, according to available information about the Oil prices.

Key-word: Oil Prices; Inflation; MIDAS; Algeria.

*Correspondingauthor: Ben Mouaffek ZERROUK

1. INTRODUCTION:

The Algerian economy faces a syndrome commonly referred to as the “resource curse”. Algeria benefits from oil price increases, which in turn tends to increase government revenue. However, oil prices flow to the economy through higher public spending, which is usually concentrated on non-productive sectors. This would become an issue as soon as oil prices decrease. The adverse economic impact of oil price booms on other traded goods in the remaining sectors, such as agriculture and manufacturing, is known as Dutch Disease. With a weak fiscal system and inefficient public spending, Algeria is facing challenges promoting revenue or at least maintaining revenue levels. Algeria is heavily dependent on oil and gas, and the energy sector has long been the backbone of the Algerian economy.

As a matter of fact, the price of oil has received significant attention as one of the main drivers of the fluctuation of significant economic variables; oil price fluctuation can have a great impact on economic variables such as consumer prices and core inflation. Since Algeria is one of the countries which are characterized by its abundant hydrocarbon resources, which make the country the largest oil producer in Africa.

1.1 from this standpoint, the present paper discusses the following question: ***What is the impact of the oil price volatility on the Algerian inflation rate during the period 2010-2022?***

1.2 Study hypothesis:

In order to answer the research problem, the following hypothesis was formulated: **"There is an immediate positive effect of Oil prices on the Inflation rate."**

1.3 The objectives and importance of the study:

The main purpose of this paper is to discuss a topic on the agenda and aims to determine whether shocks in oil prices constitute a risk to inflation in Algeria during the period 2010-2022. This study will contribute to filling the gap in the literature since This study is one of only a handful of studies that probe oil exporting countries employing a new econometric framework, namely the Mixed Data Sampling (MIDAS) regression model to deal with period or frequency difference issues of Inflation and Oil prices variables that determine the nature and strength of the relationship that binds the oil price fluctuation to the rate of inflation in Algeria; where the past studies place reliance either on the conventional estimation methods like ordinary least square (OLS)/maximum likelihood (ML) or on the aggregation of daily data to monthly. However, these approaches fail to consider the complex nature of the data applied to test the in formativeness of non-price variables. Hence, the results so obtained will never be accurate or robust.

1.4 Limits of the study:

This study discusses the effect of Oil Prices Fluctuation on Inflation in Algeria during the period 2010-2022. We relied on new data to update information on this issue, which may reveal new dimensions of the phenomenon. Therefore, the limit of the study is the Spatial-limit and the Temporal-limit, the study was in Algeria and the period of study was between 2010 and 2022.

1.5 Methodology of the study:

The methodology of the study relies on the Deductive Approach and Quantitative research to examine the effect of oil price fluctuation on the rate of inflation in Algeria by using the Mixed Data Sampling (MIDAS) regression model and using the Eviews 12 program; to deal with period or frequency difference issues

of Inflation and Oil prices variables that determine the nature and strength of the relationship that binds the oil price fluctuation to the rate of inflation in Algeria.

2. Literature Review:

2.1. Conceptual Issues:

The impacts of oil price increases on high inflation are basically reflected in three ways: the first impact appears because oil constitutes a proportion of household consumption. This proportion comprises processed products such as gasoline used for transportation and fuel used for heating, which fall into the household consumption basket within the consumer price index. The second impact is reflected in the form of consumer prices through producer prices. Firms and factories pass on the increase in energy prices to the prices of final products. In turn, this creates an impact on the consumer price index, which is an indirect effect. The third impact is that there could be an expectation of higher inflation and higher wages. In order to compensate for the decrease in real income, a negotiation process is conducted for wages. Production costs increase because of the rising of oil prices, which is called as a second round impact. Furthermore, it has been indicated that the emergence of oil supply problems could lead to an increase in energy prices; consequently, it could exacerbate the expectation of inflation (Ozdemir & Akgul, 2015, pp. 355-356).

2.2. Empirical Literature:

Investigated the asymmetric impacts of oil price changes on inflation in Algeria, Angola, Libya, and Nigeria. Three different kinds of oil price data were applied in this study: the actual spot oil price of individual countries, the OPEC reference basket oil prices, and an average of the Brent, WTI, and Dubai oil price. Autoregressive distributed lag (ARDL) dynamic panels were used to estimate the short- and long-term impacts. Also, they partitioned the oil price into positive and negative changes to capture asymmetric impacts and found that both the positive and negative oil price

changes positively influenced inflation. However, the impact was found to be more significant when the oil prices dropped. They also found that the money supply, the exchange rate, and the gross domestic product (GDP) are positively related to inflation, while food production is negatively related to inflation. (Bala & Chin, 2018)

Examined the relationship between oil price changes and the inflation rate in Algeria from 1970–2014. The study method was able to capture asymmetries in the relationship between oil price and inflation, known as nonlinear autoregressive distributed lags (NARDL). The estimated model revealed the existence of a nonlinear effect of oil prices on inflation. Specifically, they found a significant relationship between oil price increases and inflation rate; whereas, a significant relationship between oil price reduction and inflation was absent.(Lacheheb & Sirag, 2019)

Examined the asymmetry effect of oil prices on the inflation rate in Algeria during the period 1970-2017, using annual data on the Algerian economy using a NARDL model-regression model Considering both oil prices and domestic output as independent variables. The results found a relationship in the short and long term between oil prices and inflation, since rising oil prices Petrol lead to low inflation, while lower oil prices Petrol-lead to higher inflation. (Dekkiche & Djafar, 2019)

Studied the impact of oil prices volatility on inflation and economic performance in the African oil-exporting countries (Gabon, Libya, Nigeria, Algeria, and Angola) from 1995 through 2017. They employed the Pool Mean Group estimation procedure with the inference drawn at a 5% level of significance. They found that oil price volatility had a negative and significant effect on inflation in African oil-exporting countries. The study concluded that oil price volatility had a substantial impact on inflation in African oil-exporting countries. (Ogede, George, & Adekunle, 2020)

studied the effect of oil prices on the international market on the general level of prices in Algeria during the period 1980-2018, they used a system of simultaneous equations to measure the impact of oil prices on the general level of prices in Algeria, in order to understand and monitor how the final impact of the change in oil prices is transmitted on the general level of prices in Algeria. They found that there is an indirect effect between the price of oil and the general level of prices in Algeria. (Laib & Charef, 2021)

3. Methodology and Data:

In this study, the relationship between these two variables is that the Oil Price Fluctuation will indirectly increase the rate of inflation. For this sake, we use the Mixed Data Sampling (MIDAS) regression model to deal with period or frequency difference issues of Inflation and Oil Price variables. And the Almon (PDL) weighting function is used to estimate the parameters in the MIDAS regression model. Then the results of the model with this function are compared with the lag-distributed model. The model that gives the smallest error is then used to estimate the Inflation Rate in Algeria.

3.1. The MIDAS Regression Model:

To determine the MIDAS regression model, the dependent variable $Y_t$is assumed to have been sampled with a fixed sampling frequency, called the interval of reference. The independent variable is then denoted by X_t, with being the frequency of the independent variable observed during the interval of reference. The general framework of MIDAS regression proposed by Ghysels, Santa-Clara, and Valkanov (2004) is:

$$Y_t = \alpha + \beta U_t + f\left(\left\{X_{t/S}^{H}\right\}, \theta, \lambda\right) + \varepsilon_t \qquad (1)$$

where $\mathbf{Y_t}$ is the regressand at time **t** sampled at low frequency; **α** is the intercept term; $\mathbf{U_t}$ is a regressor having same data frequency as $\mathbf{Y_t}$; $X^{H}_{t/s}$ is the set of high frequency regressors with **S** values (chosen/optimal lag) for lower frequency values with time **t** and **t/S** is a positional indicator of higher frequency regressor; the function f describes the higher frequency data effect on regression with lower frequency regressand; and **b, λ,** and **θ** are coefficient vectors to be estimated.

To incorporate parsimony and greater flexibility without losing any information contained in the higher frequency space, the MIDAS approach comes with several weighing parameters such as Step weights, Beta weights, Almon-PDL weights, and Exponential Almon weights. Among these Almon-PDLs are widely used in the field of research to place restrictions on a series of lag coefficients.

For weighing mixed frequency, the Almon-PDL function uses k high-frequency lags and the coefficients are exhibited as polynomial lags of the order p in the MIDAS parameter. the mixed data sampling model with Almon-PDL weights can be presented as:

$$Y_t = \alpha + \beta U_t + \sum_{\eta=0}^{k-1} X^{H}_{(t-\eta)/S} \left(\sum_{j=0}^{P} \eta^j \theta_j \right) + \varepsilon_t$$

Unlike the DL approach, in case of MIDAS with Almon-PDL weighing function, the number of parameters to be estimated is governed by the order of polynomial lags rather than the high frequency lags, thus resulting in a more parsimonious model that captures every information from the higher frequency regresses(Mallikarjunappa, 2019, p. 191).

3.2. Data:

The dataset includes Algerian Inflation Rate data based on 2010 Constant Prices, i.e., 2010Q1 to 2022Q4, and the monthly Oil prices from January 2010 to December 2022. To estimate the parameters of the MIDAS regression model, Algerian Inflation Rate data from 2010Q1 to 2022Q4 and monthly Oil prices from

January 2010 to December 2022 are used. Furthermore, the forecasting of Algeria's Inflation Rate for the next second quarter, from 2023Q2, is done with the known data of the oil prices from January 2022 until December 2022.

4. Empirical Results:

4.1. Using MIDAS Models to measure the effect of the Exchange Rate on Inflation:

To estimate the effect of the Oil pries (POILM) with a monthly frequency on inflation (INFq) with a quarterly frequency in Algeria, we apply the Almon (PDL) Weighting - MIDAS model, by using the Eviews 12. As shown in the following Table 1.

Table 1. *Midas model estimation results*

Dependent Variable: INFQ
Method: MIDAS
Date: 04/23/23 Time: 10:33
Sample (adjusted): 2010Q3 2022Q4
Included observations: 50 after adjustments
Method: PDL/Almon (polynomial degree: 3)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INFQ(-1)	0.890746	0.076233	11.68450	0.0000
Page: OIL Series: POILM(-3) Lags: 4				
PDL01	-0.581722	1.041586	-0.558497	0.5792
PDL02	0.603968	1.106753	0.545712	0.5879
PDL03	-0.122435	0.233124	-0.525195	0.6020

R-squared	0.762013	Mean dependent var	1.476706
Adjusted R-squared	0.746492	S.D. dependent var	0.501794
S.E. of regression	0.252651	Akaike info criterion	0.163003
Sum squared resid	2.936295	Schwarz criterion	0.315964
Log likelihood	-0.075065	Hannan-Quinn criter.	0.221251
Durbin-Watson stat	1.074718		

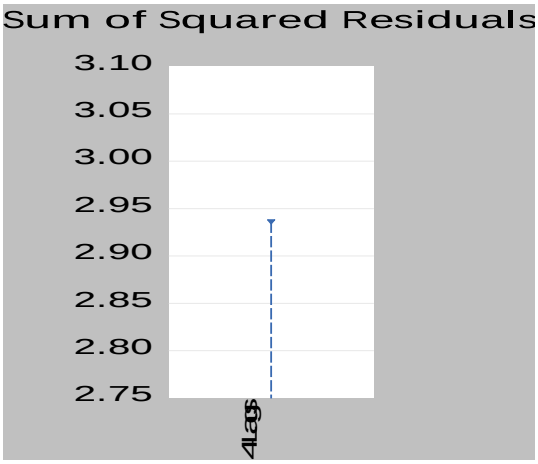
OIL\POILM(-3)	Lag	Coefficient	Distribution
	0	-0.100189	
	1	0.136473	
	2	0.128264	
	3	-0.124815	

Source: outputs Eviews 12

Through the results of Table 1, we note that the Almon coefficient for the weighting was selected on the second degree, according to the results that we reach; we found that 4 lag periods were chosen (the lowest value according to Akaike Informatio Criterion).

Furthermore, to discuss the effect of the high-frequency variable (Oil prices) on the low-frequency variable (the inflation rate); we use (Akaike, Schwarz, and Hannan Quinn) which lead to the estimation of the model, where the random error values are the least. As shown in the following Figure 1.

***Figure 1**. Optimum Lag Selection*



Source: outputs Eviews 12

Where the cases of lags in Oil prices data are compensated by 4 months, therefore according to the information standards we need the oil prices for 4 months in order to be able to interpret the inflation rate during each quarter.

Analyze the effect of the previous values of the series on the inflation rate*:*

Through the first part of Table 1, the estimation results show us the coefficients and t statistics for the low-frequency variable (inflation). As shown in the following equation.

$$\boldsymbol{INFM = 0.89INFM(-1) + \varepsilon t}$$

We note that there is positive and statistically significant effect of the previous period of inflation rate on the current period, this is consistent with economic theory, and the results confirm that inflation is affected by inflation rates in previous periods at a rate of 0.89units whenever the previous series changes by one unit. Because although higher oil prices in Algeria would increase export revenues and which may

rise the GDP level, consumer price inflation follows as well. Since oil productis the main input of many commodities and goods in the production process, productions are highly connected with oil and refined oil prices. The increase in oil price in the global market not only benefits the Algerian economy through higher export revenue but harms the economy through higher prices of many commodities and goods as well, which are not the output of the Algerian economy but exported for local demand. It would be beneficial for Algeria to produce its main required commodities and goods since oil products and gas are low and subsidized in the country.

Parameter Estimation of MIDAS Regression Model:

The second part of Table 1 shows the results of the estimation of the coefficients and statistics of the Almon (PDL) Weighting model, in which, the weighting coefficients were significant at 0.5%. That means there is a significant positive effect for every 03 months of the oil prices in each quarter of the inflation rate, additionally, this effect appears more after a period of 04 months and then fades over time, and this is shown by the distribution of the lags coefficients at the end of Table 01. Therefore, we reach the following MIDAS model estimation:

$$\boldsymbol{INFQ = 0.13POILM_t - 0.58POILM_{(t-3)/s} + 0.60POILM^2_{(t-3)/s} - 0.23POILM^3_{(t-3)/s} + \varepsilon t}$$

We note that inflation is immediately affected by Oil prices in Algeria, which agrees with economic theory, where according to the theory, the lower the value of the local currency and the higher the foreign exchange rate, lead to a rise in the prices, as a result of the higher prices of imports by the local currency .

Empirically, we found that the lower the oil prices, by one unit, the inflation rate increased by 0.13, which means there is a direct relationship between the oil prices and inflation rates in Algeria.

4.2. Robustness Checks:

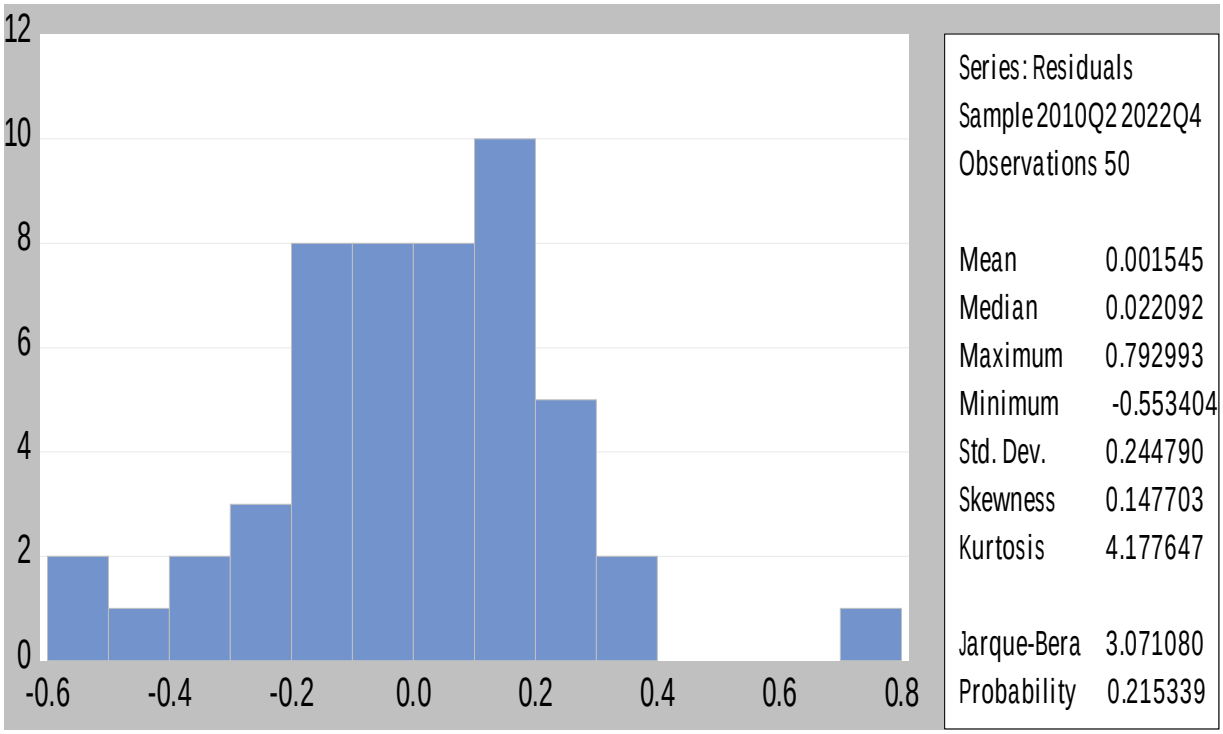
We should check the robustness of the estimated model by using Residual Diagnostics and Stability Diagnostics Before predicting the model, where the results that we reached in terms of the significance of the Almon Weighting parameters can explain 76% of the changes in inflation rate.

a-Residual Diagnostics:

a-1- Histogram and Normality Test:

To display a histogram and descriptive statistics of the residuals, we include the Jarque-Bera statistic for testing normality. As shown in the following Figure 2.

Figure 2. *Normality Test Result*



Source: outputs Eviews 12

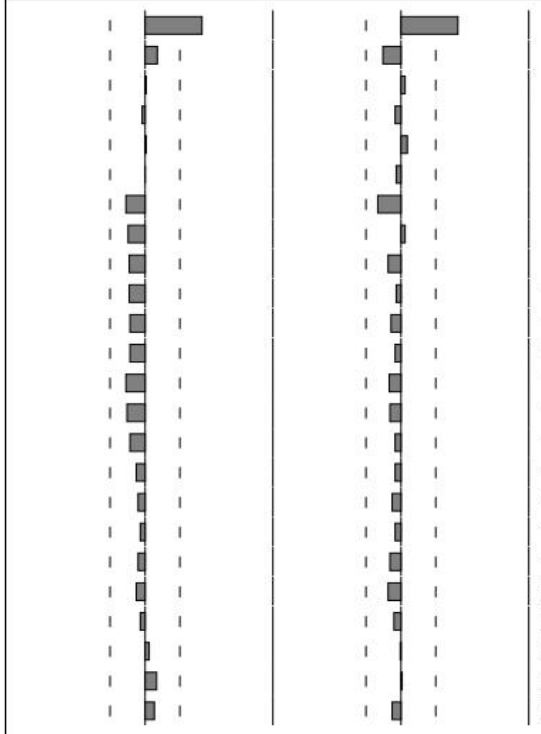
The result of the test was insignificant ($\alpha > 0.05$) and the value of J-B = 3.071 was less than $x^2 = 5.99$. This means accepting the null hypothesis, and residuals are subject to normally distributed residuals.

a-2- Error Autocorrelation test:

For testing that there is no autocorrelation, we use Autocorrelation tests, as shown in the following Table 2.

***Table 2** : Errorautocorrelation test*

Date: 04/23/23 Time: 11:49
Sample (adjusted): 2010Q3 2022Q4
Included observations: 50 after adjustments



Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob*
		1	0.464	0.464	11.425	0.001
		2	0.100	-0.147	11.964	0.003
		3	0.016	0.041	11.978	0.007
		4	-0.021	-0.041	12.003	0.017
		5	0.013	0.052	12.012	0.035
		6	0.004	-0.033	12.013	0.062
		7	-0.153	-0.187	13.434	0.062
		8	-0.132	0.038	14.519	0.069
		9	-0.125	-0.104	15.515	0.078
		10	-0.125	-0.038	16.529	0.085
		11	-0.119	-0.078	17.474	0.095
		12	-0.120	-0.047	18.457	0.103
		13	-0.152	-0.098	20.080	0.093
		14	-0.145	-0.090	21.605	0.087
		15	-0.118	-0.047	22.640	0.092
		16	-0.070	-0.043	23.011	0.113
		17	-0.057	-0.070	23.269	0.141
		18	-0.039	-0.043	23.395	0.176
		19	-0.053	-0.085	23.630	0.211
		20	-0.073	-0.102	24.086	0.239
		21	-0.038	-0.051	24.218	0.283
		22	0.038	-0.005	24.353	0.329
		23	0.096	0.009	25.245	0.338
		24	0.075	-0.073	25.813	0.363

*Probabilities may not be valid for this equation specification.

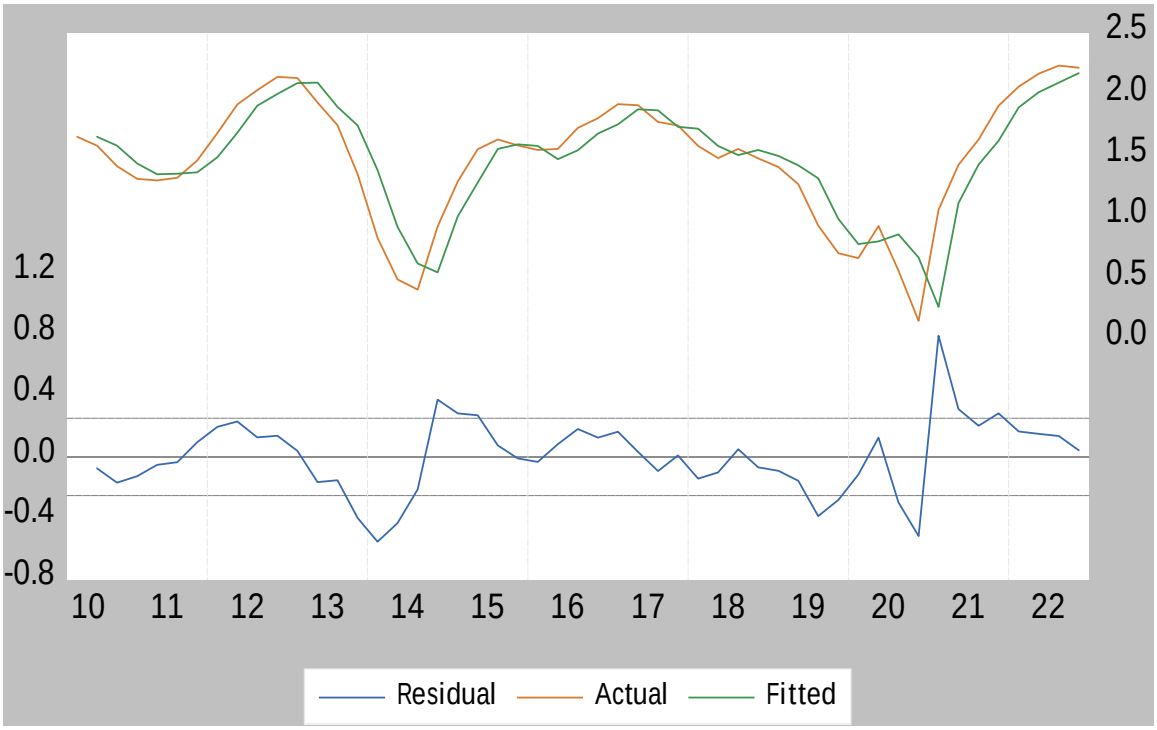
***Source**: outputs Eviews 12*

Through The results of Table, we note that all columns within the confidence interval and the Q-Star test statistic are not significant, and therefore we accept the null hypothesis that there is no autocorrelation.

a-3-The actual, fitted, and residuals Graph:

To estimate the regression of the model, we display a graph of the actual and fitted values for the variables along with the residuals. As shown in the following Figure 3.

Figure 3: *The actual, fitted and residuals Graph*



Source*: outputs Eviews 12*

Through The results of Figure 3, we observe the approximation of the fitted values of the actual values for variables, this result indicates the quality of the estimated model, for it is reliable to interpret and analyze the results.

b-Stability test:

To check whether the parameters of the model are stable or not and the model is valid for prediction, we use the ADF test. As shown in the following Table 3.

***Table 3**: ADF test*

UNIT ROOT TEST RESULTS TABLE (ADF)
Null Hypothesis: the variable has a unit root

	At Level	
		RESID01
With Constant	t-Statistic	-3.8862
	Prob.	***0.0041***
		***
With Constant & Trend	t-Statistic	-3.8444
	Prob.	***0.0221***
		**
Without Constant & Trend	t-Statistic	-3.9388
	Prob.	***0.0002***
		***
	At First Difference	
		d(RESID01)
With Constant	t-Statistic	-8.9725
	Prob.	***0.0000***
		***
With Constant & Trend	t-Statistic	-8.9593
	Prob.	***0.0000***
		***
Without Constant & Trend	t-Statistic	-9.0464
	Prob.	***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.

This Result is The Out-Put of Program Has Developed By:
Dr. Imadeddin AlMosabbeh
College of Business and Economics
Qassim University-KSA

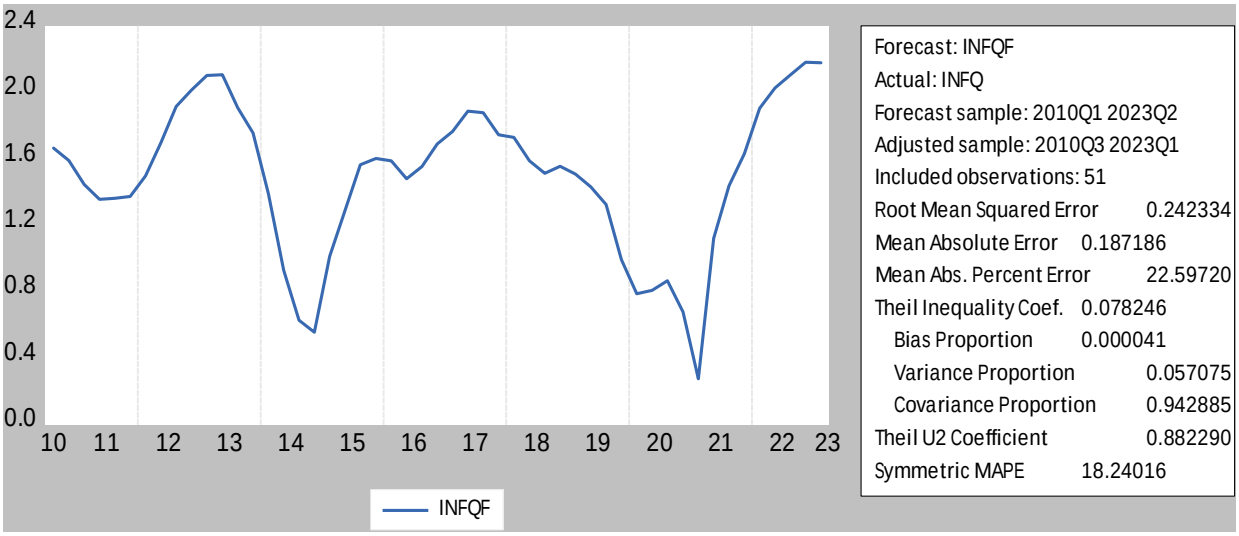
***Source**: outputs Eviews 12*

Through The results of Table 3, we note from the table and according to the ADF test, that the model residual is stable at the level, which means that the model residual is stable at 0.5%.

4.3. Forecasting Inflation rate by using the MIDAS model:

MIDAS models have a unique feature, which is the ability to take advantage of all the information available for the high-frequency variable (the exchange rate), therefore, we can predict inflation rate until the second trimester of the year 2023through the available data on the inflation rate.

Figure 4: *Forecasting Inflation rate*



Source*: outputs Eviews 12*

Trought figure 4, We note the value of the square root of the mean square error (***RMSE=0.24***), which indicates that the deviation of the predicted values from the real values is close to 0, and the value of Theil = 0.07 is almost equal to 0, and therefore we can take on the predicted numbers by using the model, where the predicted string values were as follows:

Table 5. PREDICTED VALUES

YEAR	***PERIOD***	***ACTUAL VALUES***	***PREDICTED VALUES***
2022	*Q1*	*7.93*	*6.707*
	Q2	*8.82*	*7.581*
	Q3	*9.42*	*8.207*
	Q4	*9.26*	*6.864*
2023	***Q1***	*/*	***8.834***
	Q2	*/*	***8.801***

Source Prepared by the researchers, based on Figure 4

Through the results of Table 5, we notice that the real values are in close proximity to the predicted values, which confirms the quality of the estimated model;

meanwhile, we need three-month Oil prices data to predict one triple of the inflation rate by using the MIDAS model .

As we were able, in light of the availability of Oil prices data during the first months of the year 2023, to predict the inflation rate in Algeria during the second trimester of the same year. Thus, we can periodically update the prediction that we reached every month we receive new data on the Oil prices variable.

5. Conclusion:

The study proposed MIDAS regressions resorting to Almon Lag Polynomials to determine the nature and strength of the relationship that binds the Oil prices fluctuation to the rate of inflation in Algeria during the period 2018-2022, using the Eviews program 12. The result of the empirical analysis reveals the positive impact of the frequency of the high Oil prices (monthly) on the frequency of the low Inflation Rate (quarterly) in Algeria during the period 2018-2022, which concluded that there is an immediate positive effect for Oil prices in the Inflation variable, whereas it appears in the larger way after 04 months, also the findings point to predict of inflation until the second quarter of 2023, according to available information about the Oil prices.

6. Recommandations and Perspective :

Therefore, we counsel the Algerian authorities to take the following recommendations into consideration: Should encourage domestic food production both in quantity and quality since food production is anti-inflationary. Consequently, each authority should also upkeep and inspire the private sector to invest in and grow the agricultural industry. Additionally, we recommend doing a new study about the effects of sudden changes in both crude oil prices and domestic gasoline prices on inflation in Algeria.

7- Bibliography List :

1. Ogede, J., George, E., & Adekunle, I. (2020). EXPLORING THE INFLATIONARY EFFECT OF OIL PRICE VOLATILITY IN AFRICA'S OIL EXPORTING COUNTRIES. *Economics and Organization*, 113-125.
2. Bala, U., & Chin, L. (2018). Asymmetric Impacts of Oil Price on Inflation:An Empirical Study of African OPEC Member Countries. *Energies*, 1-21.
3. Dekkiche, D., & Djafar, H. M. (2019). Impact of Fluctuations of Oil Prices on Inflation in Algeria: An Empirical Study Using NARDL Model. *Strategy and Development Journal*, 114- 134.
4. Lacheheb, M., & Sirag, A. (2019). Oil price and inflation in Algeri: A nonlinear ARDL aproach. *The Quaretely Review of Economics and Finance* , 217- 222.
5. Laib, A., & Charef, A.-k. (2021). The effect of oil prices on the general price level in Algeria. *Journal of Advanced Economic Research*, 472- 488.
6. Mallikarjunappa, T. (2019). Testing the Informativeness of Non-Price Variables with MIDAS. *IIMB Management Review, 32*, 189-207.
7. Ozdemir, S., & Akgul, I. (2015). Inflationary effects of oil prices and domestic gasoline prices: Markov-switching-VAR analysis. *Springer*, 355- 365.