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The Impact of Government Spending and Oil Prices on Economic Growth in Algeria for the Period (1990-2023) An Econometric Study Using the ARDL Methodology.

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Abstract: This research paper aims to study the impact of government spending and oil prices on economic growth in Algeria within the framework of the ARDL models for the period 1990-2023. The study concluded that government spending has no impact on long-term economic growth in Algeria, while oil prices have a positive impact on long-term economic growth and are therefore considered the most important determinant of economic growth in Algeria during the study period, which confirms its heavy dependence on oil revenues. The study recommends the need for economic diversification to eliminate economic dependence on oil revenues and confront oil price fluctuations in order to achieve sustainable economic growth.

Keywords: government spending, oil prices, economic growth, ARDL.

The introduction

Algeria, like other countries, seeks to advance its economy and achieve economic stability by achieving high rates of economic growth, which is the most important indicator of the national economy. Algeria is considered a rentier state due to its dependence on oil revenues and its position as one of the most important oil-producing and exporting countries in the Arab world, making its economy more sensitive to oil fluctuations. Therefore, we find that economic growth is subject to certain determinants that lead to accelerating growth and improving the economic situation. To achieve this, economic policies are formulated, considering both government spending and oil prices as the two most important determinants of economic growth.

Research Problem: From the above, we can formulate the main problem of the study, which we will attempt to answer using a standard model as follows:

What is the impact of government spending and oil prices on economic growth in Algeria during the study period (1990-2023)?

This main question includes the following sub-questions:

-Is there an impact of changes in government spending on economic growth during the study period in the long term?

-Is there an impact of changes in oil prices on economic growth during the study period in the long term? Study Hypotheses: Based on the main research problem and a set of sub-questions, the following hypotheses can be formulated:

Government spending has an impact on economic growth during the long-term study period.

Oil prices have an impact on economic growth during the long-term study period.

1. Previous Studies

Many applied and empirical studies have demonstrated and revealed the impact of government spending and oil prices on economic growth, particularly in economies where government spending and progress in economic growth depend on oil prices as a primary source.

Studies examining oil prices, their impact, and their relationship to economic growth have revealed variations from one study to another. Some have found a strong, positive relationship, while others have found a negative relationship between the two variables. Other studies have incorporated other variables to reveal the specific impact of oil prices and economic growth, particularly changes in macroeconomic policy indicators such as unemployment and inflation. A study by Mmadu, Okeke, & Ukpemeku (2024) reveals a strong positive relationship between oil prices and economic growth in Algeria. Initially, increases in oil prices stimulate growth; however, the long-term effects are mitigated by monetary policy adjustments and exchange rate fluctuations, underscoring the need for economic diversification. The study concludes that oil price volatility has a positive and significant impact on economic growth in African countries, particularly in Nigeria, Angola, Egypt, and Algeria, highlighting the importance of foreign direct investment and anti-corruption measures for sustainable growth. Hadji & Ben Abderrahmane (2024) examines the relationship between oil price volatility and economic growth in Algeria over the period 1973 to 2023, using vector autoregressive (VAR) analysis, impulse response functions (IRFs), variance analysis (VD), and Toda-Yamamoto causality testing. The results reveal a strong positive relationship between oil prices and economic growth, confirming the critical role of hydrocarbon exports in driving the Algerian economy. However, this relationship is influenced by other macroeconomic factors, such as inflation, exchange rates, and money supply. While higher oil prices initially stimulate economic growth, the long-term effects are moderated by monetary policies and exchange rate changes. The analysis of variance also shows that oil price fluctuations significantly impact economic performance in the short term, but their impact diminishes over time, indicating progress in economic diversification efforts, policy adaptation, and the ability to manage oil fluctuations. An article by Ismail Abiodun Taiwo, Jayeola, & Adewale Samson Adefokun (2024) included a study on the impact of oil price fluctuations on economic growth in the United States. The study aimed to clarify the relationships between these macroeconomic variables and economic growth. Descriptive statistics revealed significant variation in oil price fluctuations, unemployment rates, interest rates, and inflation, all of which impact the economic landscape. Correlation analysis indicates positive correlations between GDP and oil price volatility, interest rates, and inflation, while a negative correlation is found with unemployment rates. The results confirm the critical impact of oil price stability and labor market conditions on economic performance. Based on these findings, the study recommends policies to mitigate oil price volatility, enhance labor market stability, and promote economic diversification. These findings contribute to a deeper understanding of the factors influencing economic growth.

The authors (Nor Balkish Zakaria, Kazi, Norazida, Rahayu, & Azmi, 2023) studied the impact of oil prices and government spending on economic growth in Malaysia. They relied on monthly time series data spanning the years 2000 to 2021, and analyzed them using an autoregressive distributed lag (ARDL) model to examine the short- and long-term effects. The study concluded that oil prices have a positive impact on economic growth in both the short and long term, given that Malaysia is effectively an oil-exporting country, and despite the volatility of oil prices, the country generates significant revenues from this sector. Higher oil prices stimulate economic activity, allowing the government to allocate more funds to various productive sectors in the country from the revenues generated by the oil sector. Government spending also found a significant positive impact on economic growth in both the short and long term. This confirms the hypothesis that oil prices and government spending contribute positively to supporting the Malaysian economy in both the short and long term. A study (Darma, Magaji, & Amase, 2022) analyzed and measured the relationship between oil prices, government spending, and economic growth in Nigeria during the period 1986 to 2018, an era marked by bold reforms. The study found a direct and statistically significant relationship between oil prices and both government spending and economic growth. Furthermore, the exchange rate and export channels act as mediators for transmitting oil price shocks to the economy. The generalized moment equations (GMM) methodology and the vector error correction technique (VECM) were used to analyze the relationship between the studied variables. Given the global trend toward

decarbonizing the energy sector, the study recommends an urgent shift in growth policies away from reliance on oil revenues and toward bold reforms that contribute to accelerating the diversification of fiscal revenues and exports, with a focus on private sector initiatives to achieve economic sustainability. The study (Rasheed, 2023) analyzes global oil price fluctuations and identifies the factors that control them. It also seeks to clarify the nature and characteristics of the international oil market, in addition to examining the relationship between oil, public spending, and the economy in rentier states. It also aims to provide insights into the economic impacts of oil dominance and track trends in oil, public spending, economic growth, and development in Iraq. Furthermore, it seeks to assess the extent to which the fiscal policies pursued by rentier states achieve their objectives and propose ways to ensure rationalization of public spending and achieve real economic growth in these countries. The study's findings indicate that oil rents lead to decreased efficiency and increased centralization of power, and also create patterns of public spending that reduce economic effectiveness. Rentier economies face challenges in diversifying their sources of income and reducing their dependence on oil exports. Commitment to budgets and the development of transparent and flexible principles are crucial to achieving real economic growth in rentier states. Effective management of oil revenues and public spending is essential for achieving sustainable economic growth in these economies.

2. Methodology

The research methodology utilizes the Autoregressive Distributed Lag (ARDL) model. The ARDL methodology, or bounds test, was developed by Pesaran & Shin (In Econometrics and Economic Theory in the 20th Century: The Ragnar Frisch Centennial Symposium, 1999), and later expanded upon by Pesaran, Shin, & Smith (2001). The method is suitable for small samples, as the bounds test is used in cases where the series are integrated at different orders (I(0) and I(1)). (Kripfganz & Schneider, 2018)

In this context, the ARDL methodology (autoregressive models with distributed lags) was chosen for its flexibility and ability to overcome the limitations associated with the Johansen test, particularly with regard to the requirement for integration of the same order.

3.Description of the Variables

To measure the impact of government spending on economic growth in Algeria, a set of variables was used that can demonstrate and express the study's objective. We list them as follows:

- Government Spending

Public spending was chosen as a variable representing government expenditures in Algeria, as public spending refers to the amount of money spent by the government on goods and services to directly meet individual or collective needs of society (Sanheev, 2023, p. 43).

We selected government expenditure (GEXP) in Algeria as a percentage of GDP, using an annual time series from 1990 to 2023, based on the World Bank database.

- Oil Prices

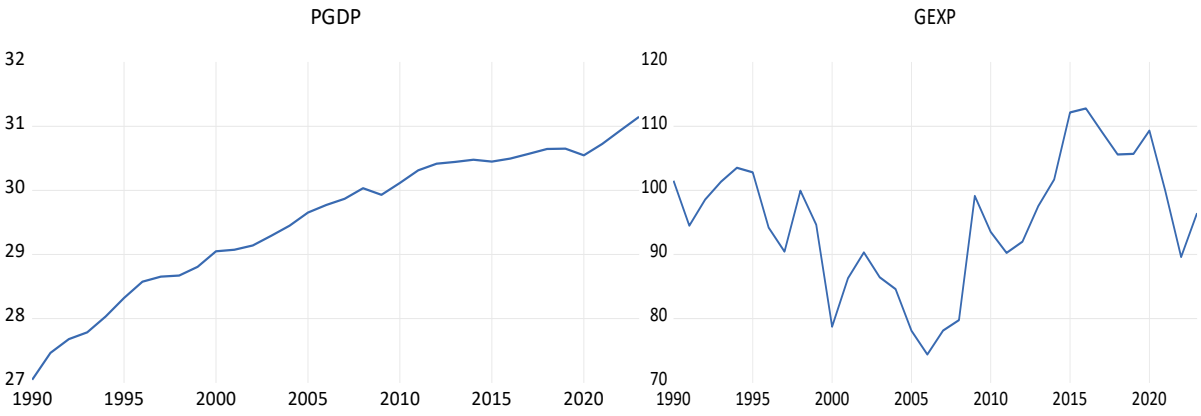
Algeria is a rentier country that relies heavily on oil prices to drive its economy. Therefore, we used oil prices (PP) as a control variable for the econometric study, using an annual time series from 1990 to 2023 from the OPEC Basket Price.

- Economic Growth

When referring to the definition of economic growth, we refer to the increase in an economy's capacity to produce goods and services compared between two time periods (Raisova & Durcova, 2014).

Therefore, an annual time series from 1990 to 2023 was selected to represent the economic growth variable, using the annual growth of GDP (GDP) at constant prices in Algerian dinars from the World Bank database.

Figure 1: Evolution of time series of study variables



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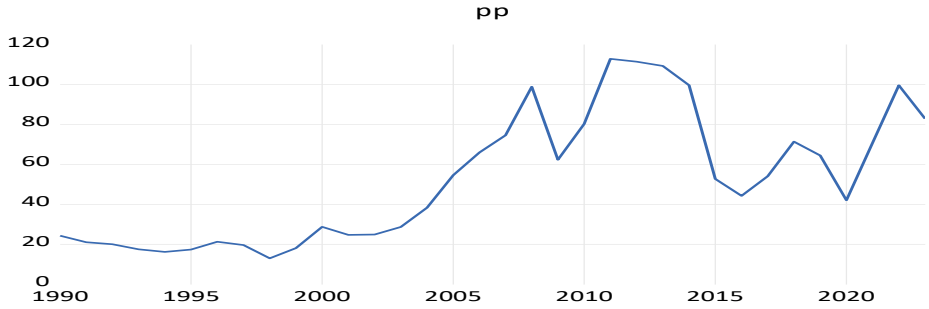


Source: Eviews12 program outputs based on World Bank data

4. Results of the applied study

4-1 Unit Root Stationarity Test (ADF-PP)

Before selecting the appropriate model and estimating the relationship and long-term impact between the study variables, we will study the stationarity of the time series variables at the At Level and at the At First Difference using the ADF-PP tests

-Phillips-Perron (PP) test

Table 1: Results of the Phillips-Perron (PP) test for time series stationarity

	At Level			
		PGDP	GEXP	PP
With Constant	t-Statistic	-5.5723	-2.1179	-1.4521
	Prob.	0.0001	0.2392	0.5449
		***	n0	n0
With Constant & Trend	t-Statistic	-3.4406	-2.1761	-2.2318
	Prob.	0.0632	0.4866	0.4574
		*	n0	n0
Without Constant & Trend	t-Statistic	5.1713	-0.3253	-0.0840
	Prob.	1.0000	0.5605	0.6473
		n0	n0	n0
	At First Difference			
		d(PGDP)	d(GEXP)	d(PP)
WithConstant	t-Statistic	-4.6492	-5.6412	-5.2705
	Prob.	0.0008	0.0001	0.0001
		***	***	***
With Constant	t-Statistic	-4.9432	-5.5324	-5.1368

& Trend				
	Prob.	0.0019	0.0004	0.0012
		***	***	***
Without Constant & Trend	t-Statistic	-2.9373	-5.7659	-5.2797
	Prob.	0.0046	0.0000	0.0000
		***	***	***

Source: Eviews12 program outputs

- ADF test

Table 2: Results of the ADF test for time series stationarity

	At Level			
		PGDP	GEXP	PP
With Constant	t-Statistic	-3.4515	-2.0486	-1.4891
	Prob.	0.0161	0.2658	0.5266
		**	n0	n0
With Constant & Trend	t-Statistic	-3.1781	-2.1847	-2.2318
	Prob.	0.1062	0.4820	0.4574
		n0	n0	n0
Without Constant & Trend	t-Statistic	6.1197	-0.3344	-0.2592
	Prob.	1.0000	0.5570	0.5851
		n0	n0	n0
	At First Difference			
		d(PGDP)	d(GEXP)	d(PP)
With Constant	t-Statistic	-4.6401	-5.5611	-5.2621
	Prob.	0.0008	0.0001	0.0002
		***	***	***
With Constant & Trend	t-Statistic	-4.6852	-5.4681	-5.1647
	Prob.	0.0037	0.0005	0.0012
		***	***	***
Without Constant &	t-Statistic	-2.9995	-5.6635	-5.2658

Trend				
	Prob.	0.0039	0.0000	0.0000

Source: Eviews12 program outputs

From the previous table, which displays the results of the ADF and PP tests, and using the Eviews12 software, it is clear that the study variables are stationary series, a combination of level I0 and first difference I1 at a probability value of 5% in all cases (presence of a constant, presence of a constant and a general trend, and absence of a constant and a general trend). Therefore, we can apply the ARDL methodology to the study variables.

4-2 Determining the Optimal Model

Selecting the optimal model based on the Akaike Information Criteria (AIC)

To determine the appropriate model using the optimal lags, we used the Akaike Information Criteria (top 20).

According to the AIC criterion, the appropriate and optimal model that was identified is (ARDL(1,1,0), meaning that the dependent variable (PGDP), which is expressed by GDP growth, has a single lag (lag = 1), while the independent variables (government spending (GEXP), have a single lag, and oil prices (PP), have no lag.

Therefore, the model takes the following form:

where:

Δ: Differences of degree First

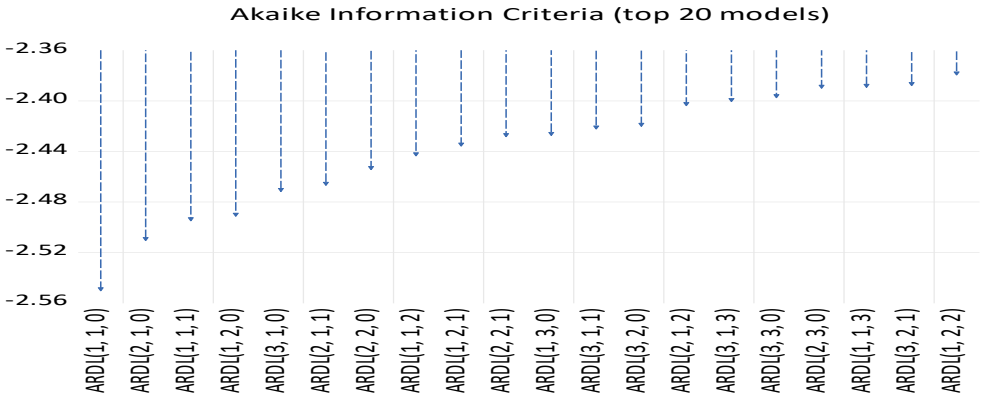
C_0: Constant term

ε: Random error

α_(1,)α_2: Short-term relationship coefficients

β_2,β_1: Long-term relationship coefficients

Figure 2: Testing the gaps appropriate for the study model



Source: Eviews12 program outputs

3-4 Bounds Test

To test for the presence of a long-run relationship between variables, we use Fisher's F-Bounds Test.

If the calculated F value is above the upper bound I(1) at the significance level, the null hypothesis, which states that there is no long-run equilibrium relationship, is rejected. If the F statistic test confirms the presence of a single long-run relationship between the variables (i.e., between the primary variables), the ARDL approach can be applied (Ketenci, 2009, p. 8.(

Null Hypothesis (H_0): There is no long-run relationship between the variables.

Alternative Hypothesis (H_1): There is a long-run equilibrium relationship between the variables.

Since the calculated F value (39.43570) is much greater than all critical values at all significance levels, we reject the null hypothesis H_0, which means there is a long-run equilibrium relationship between the variables.

That is, there is a long-run relationship between economic growth (PGDP), government spending (GEXP), and oil prices (PP)

Table 3: Concurrent integration testing according to the ARDL methodology

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	39.43570	10%	2.63	3.35
k	2	5%	3.1	3.87
		2.5%	3.55	4.38
		1%	4.13	5
ActualSample Size	33		FiniteSample: n=35	
		10%	2.845	3.623
		5%	3.478	4.335
		1%	4.948	6.028
			FiniteSample: n=30	
		10%	2.915	3.695
		5%	3.538	4.428
		1%	5.155	6.265

Source: Eviews12 program outputs

4-4 Long-run Estimation

After confirming the existence of a long-run complementary relationship between the study variables, the long-run relationship can be estimated, as shown in the results of the following table:Table 4: Estimation of the Long-Run Relationship

Levels Equation				
Case 2: Restricted Constant and No Trend				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
GEXP	0.006579	0.013328	0.493623	0.6254

PP	0.020867	0.003960	5.269976	0.0000
C	29.10643	1.434709	20.28734	0.0000
EC = PGDP - (0.0066*GEXP + 0.0209*PP + 29.1064)				

Source: Eviews12 program outputs

The results of the long-run relationship estimation show the following:

First: The Effect of Government Expenditure (GEXP)

Coefficient = 0.006579: Indicates that a one-unit increase in government expenditure leads to a 0.0066-unit increase in gross domestic product (GDP) in the long run.

T-Statistic = 0.493623 and p-value = 0.6254.

Since the p-value is greater than 0.05, the effect is statistically insignificant, meaning that GEXP does not significantly affect GDP in the long run.

Second: The Effect of Oil Prices (PP)

Coefficient = 0.020867: Indicates that a one-unit increase in oil prices leads to a 0.0209-unit increase in GDP in the long run.

t-statistic = 5.269976 and p-value = 0.0000.

Since the p-value is less than 0.05, the effect is statistically significant, indicating that oil prices significantly affect economic growth.

5-4 Short-run Estimation

Table 5: Short-run Relationship Estimation and Error Correction Model

ECM Regression Case 2: Restricted Constant and No Trend				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GEXP)	-0.008506	0.001521	-5.593179	0.0000
D(PP)	0.0957	0.001318	0.726320	0.4733
CointEq(-1)*	-0.090475	0.006846	-13.21529	0.0000

R-squared	0.724949	Meandependent var	0.124334
Adjusted R-squared	0.716077	S.D. dependent var	0.112180
S.E. of regression	0.059775	Akaike info criterion	-2.737776
Sumsquaredresid	0.110764	Schwarz criterion	-2.647078
Log likelihood	47.17330	Hannan-Quinn criter.	-2.707259
Durbin-Watson stat	1.189929		

Source: Eviews12 program outputs

To determine how quickly short-term errors are corrected using the Error Correction Model (ECM), we obtained the following results:

First: Error Correction Term Value: (CointEq-1)

Coefficient = -0.090475 indicates the speed of correction of imbalances towards equilibrium. P-value = 0.0000 is highly significant, and t-Statistic = -13.21529 is a high negative value, indicating a strong correction.

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Thus, 9.05% of imbalances are corrected in each period, indicating the presence of a long-term equilibrium relationship between the variables. This means that any imbalance that occurs in the short run is partially corrected in each period. The gradual correction occurs at a rate of 9.05% annually, which indicates that the adjustment is relatively slow.

Second: Change in government spending: (GEXP)D

Coefficient = -0.008506: A very small negative impact on economic growth. The p-value = 0.0000 is highly significant at all statistical levels. The t-statistic = -5.593179 is a highly negative value, indicating a strong negative impact.

Thus, an increase in government spending leads to a slight decrease in economic growth in the short term, which is a statistically significant impact.

Third: Change in oil prices: (D(PP)

Coefficient = 0.0957: A positive impact. The p-value = 0.4733 is insignificant, because the t-statistic = 0.726320 is very small, indicating a weak impact of the variable.

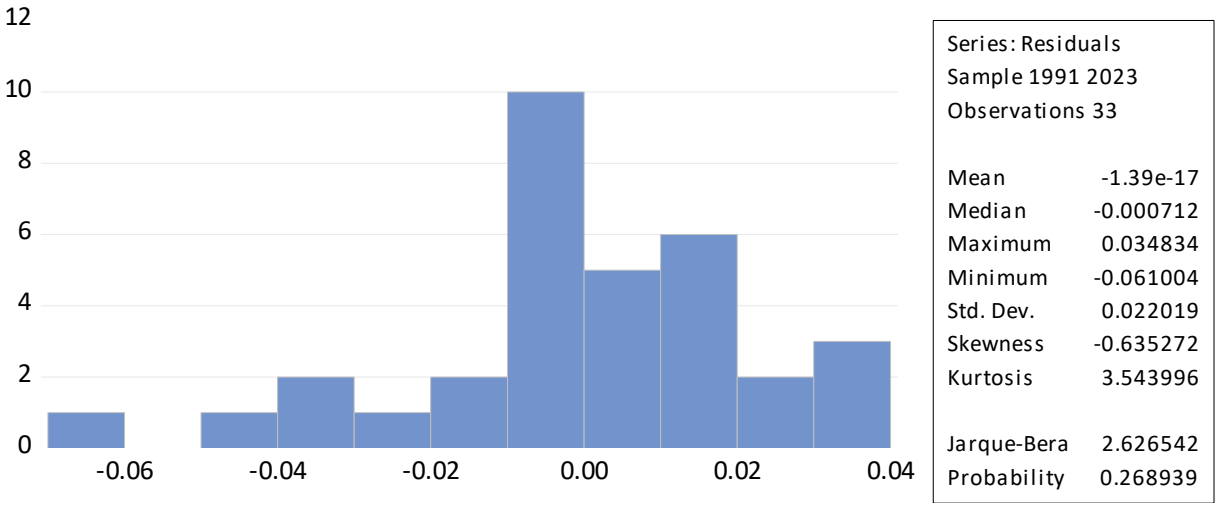
Therefore, there is no strong statistical evidence that oil prices (PP) affect economic growth in the short term.

6-4Model Validity Test

To verify the validity of the selected model, we conducted a set of diagnostic tests for the residual series, which we list as follows:

First: Testing the normal distribution of the residual series:

Figure 3: Testing the normal distribution of the residual series



Source: Eviews12 program output

To ensure that the series of residuals is normally distributed, a Jarque-Bera test is performed.

We can see from the figure that the residuals are normally distributed (the normal distribution hypothesis is met), because the Jarque-Bera probability statistic is 0.2689, which is greater than 0.05. Therefore, we accept that the residuals are normally distributed within the 95% confidence interval.

Second: Serial Correlation of Residuals and Variance of Variance

Heteroskedasticity Test Analysis

The heteroskedasticity test is used to determine whether the error variance in the model is constant across all values, an important assumption in economic and statistical models. Here we have two main tests:

 Breusch-Pagan-Godfrey test:

t-Statistic = 0.296510

Prob (F-statistic) = 0.8777

The probability value (0.8777) is greater than 0.05, which means we do not reject the null hypothesis that the variance is homoskedastic. That is, the model does not suffer from the problem of heteroskedasticity.

 ARCH test (Autoregressive Conditional Heteroskedasticity)

t-Statistic = 0.357620

Prob (F-statistic) = 0.5543

This test is used to test for the presence of conditional heteroskedasticity, as seen in GARCH models. The probability value (0.5543) is greater than 0.05, which means we do not reject the null hypothesis of no conditional heteroscedasticity. This means that the model does not suffer from the ARCH problem and that the variances of the residuals are not correlated with time.

Based on the results of both tests, we can say that the model does not suffer from the heteroscedasticity problem, which means that the assumption of constant variance is met and that the model is virtually free of statistical problems.

Table 6: Serial Correlation of Residuals and Variance of Variance

Test	t-Statistic	Prob
Heteroskedasticity Test Breusch-Pagan-Godfrey	0.296510	F(4,28) 0.8777
Heteroskedasticity Test: ARCH	0.357620	F(1,30) 0.5543

Source: Eviews12 program output

Third: Stability of the Model Structure

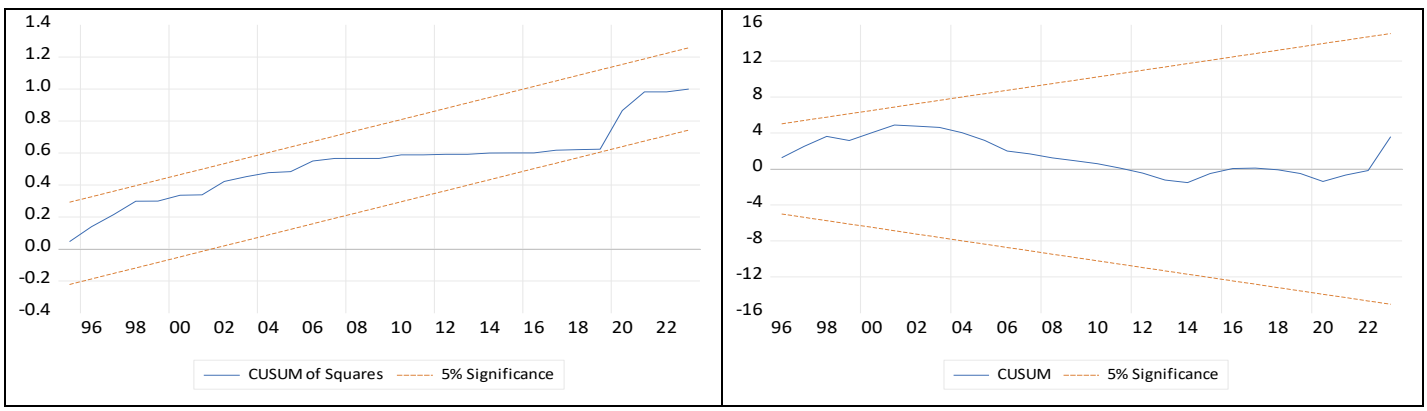
To ensure that the data used in the study are free of any structural changes over time, the CUSUM and CUSUM of Squares tests are used. These tests are important tools for examining the stability of the model's coefficients in the short and long term.

From the two figures presented, we note that the CUSUM statistic falls within the critical limits (marked by dashed lines), indicating that the model's coefficients are stable and that there is no significant structural change over the time period under study.

Similarly, the CUSUM of Squares statistic also appears within the critical limits at the 5% significance level, indicating that the error variance is stable and that there are no sudden changes or major disturbances in the model structure.

Since both tests showed results within the critical limits, we can conclude that the estimated model is stable, and its coefficients are constant over time.

Figure 4: CUSUM of Squares and CUSUM tests for model structural stability



Source: Eviews12 program output

5.Conclusion and Discussion of Results

The aim of this study is to present one of the most efficient and modern dynamic models, the Autoregressive Distributed Lag (ARDL) model, by applying it to economic growth in Algeria. This model is distinguished by its ability to address the problem of mixed time series, both stationary and non-stationary, as it can handle integrated series of different orders. It also overcomes the problem of autocorrelation that occurs in the ordinary least squares method, which is consistent with the nature and outputs of the time series data used in our study.

This model is considered flexible and highly suitable for the nature and subject of the study, as it examines the impact of oil prices and public spending on economic growth. This model is compatible with this model, as it helps measure this impact, especially in the case of Algeria and its unbalanced economic structure due to its connection to oil prices, which suffer from fluctuations and a range of shocks.

The results indicate a long-term equilibrium relationship between economic growth (PGDP), government spending (GEXP), and oil prices (PP). The optimal model to describe this relationship was found to be (1,1,0 ARDL). Regarding the long-term effects, we found that the long-term effect of GEXP (government spending) is insignificant, meaning that it may not play a significant role in determining economic growth within this model. However, its short-term effect is negative and significant, which may indicate that increased government spending in the short term leads to negative effects on economic growth, perhaps due to misallocation of resources or inflationary effects. This can be explained by the inefficiency of government investment, the dominance of operating expenses (management expenses) at the expense of investment expenditures, and the increase in government support at the expense of investment. This may indicate the need for financial reforms to improve the efficiency of government spending.

The oil price variable (PP) has a strong and significant positive effect on GDP, indicating that oil prices are important in supporting economic growth in Algeria in the long term. The short-term effect of oil prices (PP) is insignificant, meaning that this variable does not play a significant role in the short-term effects on The dependent variable may be the reason that the real effect appears only in the long term and not the short time periods studied within the results of this model. For this result, it is very logical given that the Algerian economy depends largely on oil revenues and given that its fluctuations in global markets are large and unstable and are not determined by fixed factors that determine the extent of its stability, which leads us to the fact that economic diversification is a necessity that must be placed as a priority to get out of this cycle.

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