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An Econometric Study of the Relationship between Oil Price Volatility and Public Spending in Algeria during the Period (1990–2024)

دراسة قياسية للعلاقة بين تقلبات أسعار النفط والإنفاق العام في الجزائر خلال الفترة (1990–2024)

***HeddamFeriel**
University of 20 Aout- Skikda- (Algeria),
Laboratory ECOFIMA
Ferial.hed21@gmail.com

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Abstract :
The study aimed to examine the relationship between oil price volatility and public spending in Algeria over the period from 1990 to 2024. The analytical approach was adopted to trace the trajectory of oil prices in the international market and the evolution of public spending levels in Algeria throughout the study period. In addition, an econometric approach was employed to assess the impact of oil price fluctuations on public spending by developing an econometric model and conducting an empirical analysis within the framework of the Autoregressive Distributed Lag (ARDL) methodology.

The study concluded that a significant positive long-run relationship exists between oil prices and public spending, alongside a significant negative short-run relationship. This indicates that public spending trends in Algeria are closely associated with fluctuations in oil prices in the international market. This finding is consistent with the characteristics of rentier economies, which rely heavily on revenues generated by the oil sector through petroleum taxation.

Keywords: oil prices, public Spending, Oil Revenues, Rentier economy, ARDL Model

JEL Classification Codes: H50, G40, H54, D72, C32**.**

Corresponding author

1. ntroduction.

Since its discovery, oil has remained the world's primary source of energy, as it constitutes an essential strategic commodity that cannot be dispensed with and a major driver of global economic development. However, oil prices have experienced sharp and unexpected fluctuations in global markets over the past decades, paving the way for fundamental transformations in the global oil market. These developments have resulted in the succession of several oil crises, whose repercussions have affected the economies of both oil-exporting and oil-consuming countries. Such developments demonstrate the extent to which oil prices are influenced by and subject to various economic, financial, and technical factors. Oil prices do not move solely in accordance with the law of supply and demand, they also respond to the policies adopted by governments in oil-producing countries and to geopolitical tensions, in addition to transformations associated with alternative energy sources. Accordingly, the trajectory of oil prices represents a fundamental determinant of growth trends in both oil-exporting and oil-consuming economies.

Since the 1970s, Algeria's development process, like that of other oil-producing countries, has been based on petroleum tax revenues and their allocation to financing public Spending. This has rendered the Algerian economy vulnerable to oil price fluctuations characterized by alternating periods of increases and declines thereby exposing it to shocks and instability. Furthermore, prolonged periods of low oil prices have reduced the state's capacity to finance its financial obligations and cover public spending. This has made it difficult to overcome the country's dependence on oil resourceswhich are derived from a single and ultimately exhaustible source of revenue, particularly in the absence of effective incentives to develop alternative sources of income capable of ensuring the financing of public spending and achieving balanced economic development.

Research Problem:

To what extent do oil prices affect public spending in Algeria during the period (1990–2024)?

Based on the research problem, the following main hypothesis was formulated:

There is a statistically significant effect of oil prices on public spending in Algeria during the period (1990–2024).

Study Objectives: The study aims to examine the impact of oil price fluctuations on the direction of public spending in Algeria during the period (1990–2024), by identifying the most significant developments in oil prices in the international market, as well as the

major stages through which public spending in Algeria evolved during the study period.

Methodology: The descriptive and analytical approaches were adopted to examine the developments and trends in oil prices in the international market, in addition to analyzing the state of public spending in Algeria during the period (1990–2020). The econometric approach was also adopted by conducting an empirical study to determine the impact of oil price fluctuations on public spending in Algeria during the period (1990–2024), with the aim of identifying the long-run and short-run relationships using the Autoregressive Distributed Lag ARDL methodology, based on the statistical software E-Views 12.

Previous Studies:

-Study by QawaderAmjed (2018), entitled Impact of Oil Price Change and Tax Revenues External Grants and Certain Budget Variables on Government Expenditures. The study aimed to examine the impact of oil prices on certain general budget variables (public expenditure taxes, and the budget deficit) in Jordan during the period 1992–2015. The study reached several findings, the most important of which was the existence of a significant positive relationship between oil prices, taxes, and public expenditure, while a significant negative relationship was found between oil prices and the budget deficit.

-Study by Aboubaker El Sidiq Ahmed (2018), Impact of Crude Oil Price Fluctuations on Governmental Expenditures in Sultanate of Oman (1990–2020). The study aimed to investigate the relationship between oil price fluctuations and public expenditure in the Sultanate of Oman through an econometric analysis using the ARDL methodology. The study concluded that a long-run equilibrium relationship exists between oil prices and public expenditure.

-Study by Ben SaadaAbdelhalim (2020), entitled The Impact of Oil Price Fluctuations on Public Expenditure as a Main Driver of Long-Term Economic Growth in Algeria: An Econometric Study During the Period (1980–2018). The study aimed to examine the reciprocal effects among oil prices, public expenditure, and economic growth in Algeria using the Vector Error Correction Model (VECM). The study concluded that a significant relationship exists among the three variables in both the long and short run.

-Study by Adel Mokhtari (2021), entitled The Impact of Oil Price Fluctuations on Some Macroeconomic Variables Using the SVAR Methodology, for the Period (1980–2018). The study examined the impact of changes in oil prices on public expenditure, the unemployment rate, and the money supply during the period extending from 1980 to 2018 through the application of the Structural Vector Auto-regression methodology. The study

concluded that a positive relationship exists between oil prices and both public expenditure and the money supply, while an inverse relationship was found between oil prices and the unemployment rate.

-Study by Maidi Mohammed Elamnie (2022), entitled The Impact of Oil Price Fluctuation on Public Expenditures in Algeria. The study examined oil price fluctuations and their impact on public expenditure in Algeria during the period 1986–2020, using the Engle and Granger methodology. The study reached an important finding, namely, the existence of a positive relationship between oil prices and public expenditure in both the short and long run.

2. The Theoretical Relationship between Oil Prices and Public Spending:

The financing capacity of oil-producing economies is closely associated with oil resources, as they represent a fundamental source that contributes to determining the direction and priorities of government public spending through the flows of petroleum tax revenues they generate. Oil resources also contribute to maintaining economic stability. Consequently, public spending in oil-producing economies differs from that in other economies in terms of its levels, directions, and underlying determinants.

2.1. Oil Revenues and Public Spending:

Public revenues are regarded as one of the most important fiscal policy instruments that enable governments to fulfill their financial obligations, particularly with regard to income redistribution within the economy through public spending policies. Oil revenues constitute one of the primary sources of such revenues encompassing returns generated from the sale of crude oil and its derivatives in international markets. However, these revenues are characterized by instability due to fluctuations in oil prices and changes in production and export levels. Their significance stems from the fact that oil is a strategic commodity with international implications, particularly in rentier economies, where the oil sector plays a pivotal role across various economic activities (AL-fandi, 2012, p. 59)

Rentier states also rely, to varying degrees, on crude oil revenues to finance their public budgets, with the extent of this dependence differing from one country to another, given that the crude oil sector is one of the most vital sectors in the economies of these countries due to the substantial financial revenues it generates. Since the public budget consists of public revenues and public spending, a positive relationship exists between oil revenues and public spending. This relationship is determined by oil prices, making

public expenditure contingent upon changes in oil prices and oil revenues in these countries (AL-Tohma & Atshan , 2017, p. 11)

2.2. The Absorptive Capacity of Public Spending:

Most oil-producing countries rely on oil revenues to meet their financial obligation, which contributes to economic instability. This is attributable to the close relationship between oil revenues and fluctuations in oil prices or export volumes, resulting in fluctuations in the levels of government public spending, given these countries' reliance on oil revenues to finance both consumption and investment spending. When oil prices rise in the international market, public spending increases in both of its components, namely, consumption spending and investment spending. However when oil prices declineaccompanied by a decrease in oil revenues, adjustment is most often made at the expense of investment expenditure. Rentier economies consequently become accustomed to operating under conditions of high national exchange rates, leading to the emergence of symptoms of Dutch disease in the productive sectors of the economy (Tuama & Al-aaraji, 2018)

This can be explained by the fact that consumption spendig is characterized by high absorptive capacity and flexibility, making it more effective in terms of financial implementation and contributing to more substantial economic impacts. In contrast, investment spending has lower flexibility in terms of absorptive capacity and lower rates of actual utilization, resulting in evident weaknesses in implementation and the realization of its benefits. Consequently surplus allocations initially earmarked for investment spending in the public budget are, in most cases, redirected toward the annual expansion of current spending. This expansion, in turn, generates additional consumer spending that the national economy cannot immediately accommodate through domestic supply, thereby increasing reliance on imports to bridge the supply gap (AL- Kuwari, 2009, p. 59)

2.3. Efficiency of Public Spending under RentierBehavior:

The concept of efficiency in economic thought refers to the state's ability to maximize public benefits for members of society at the lowest possible cost, based on the pattern of allocating the financial resources available to the state. Efficiency represents the optimal means of implementing the state's plans, whereby financial resources are utilized through public spending, which represents the inputs, to generate outcomes for the national economy, represented by outputs. Thus, the greater the volume of inputs, the greater the resulting outputs (Falah, 2008, p. 60).

- The efficiency of public spending in states is influenced by the manner in which public spending is allocated among its various sub-sectors. Therefore, identifying the optimal spending mix within each sector contributes to improving the efficiency of public expenditure

without requiring adjustments to the overall expenditure share allocated to that sector (El-baz Mahmoud, 2014, p. 20)

Development in rentier economies relies heavily on oil revenues. When oil prices remain high for extended periods, this contributes to achieving high rates of economic growth, which, in turn, affects the performance and effectiveness of various economic sectors.

- Rentier states rely largely on external resources to finance public spending, particularly oil revenues. Consequently, they often exhibit lower levels of efficiency compared with countries that finance their budgets primarily through taxation. This can be attributed to weaker institutional and oversight incentives to improve the efficiency of resource utilization when reliance is placed on oil revenues.
- Corruption negatively affects the efficiency of public spending in rentier economies, as it contributes to increasing the volume of public expenditure through the apparent inflation of investment project costs, while simultaneously reducing the funds actually available for public spending through embezzlement and theft or through the opening of bank accounts for public officials. This ultimately leads to the waste and squandering of state funds that could otherwise contribute to financing the public treasury through their allocation to the establishment of investment projects (Abad, 2008, p. 282).

3. Analysis of the Developments in Oil Prices and Publicspending in Algeria During the Period (1990–2024):

Since the beginning of the 1970s, the global economy has witnessed a succession of several oil crises resulting from fluctuations in oil prices in the international market. These crises have had severe repercussions on oil-producing and exporting countries, including Algeria, which has experienced structural imbalances due to the dominant contribution of the oil sector to the formation of its gross domestic product (GDP). This situation stems from the country's heavy reliance on oil revenues, which are largely determined by fluctuations in international oil prices, thereby generating adverse effects on the country's financial and economic stability. In this context, we analyse the evolution of oil price trends in the international market, as well as the various stages of public expenditure development in Algeria.

3.1. Evolution of Oil Prices in the International Market During the Period (1990–2024):

The international oil market has witnessed a succession of several oil crises as a result of pronounced volatility in oil prices, which have alternated between periods of increase and decline. These fluctuations have resulted from disruptions in the fundamental market forces of supply and demand and have, in turn, been influenced by a range of economic and geopolitical factors.

At the beginning of the 1990s, oil prices rose from USD 22.3 per barrel to USD 40 per barrel as a result of the repercussions of the Second Gulf War. However, prices subsequently declined due to the contraction in global oil demand and the slowdown in global economic growth, in addition to the efforts of industrialized

countries to build up oil reserves in anticipation of developments in Iraq, followed by an economic recession that affected Asian countries in 1998. This was further compounded by intensifying competition among OPEC members and their failure to comply with production ceilings. As a result, oil prices collapsed to approximately USD 12.2 per barrel in 1998 prompting OPEC countries to reduce their production, followed by several producers outside the organization. This contributed to a renewed recovery in oil prices which reached USD 17.4 per barrel during the year 1999, driven by increased oil demand coinciding with the recovery and resurgence of the economies of East Asian countries following the financial crisis.

Table (1): Evolution of Oil Prices in the International Market During the Period (1990–2024)

Years	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**
Oil price	22.2	18.6	18.4	16.3	15.5	16.8	20.2
Years	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**
Oil price	18.6	12.2	17.4	27.6	23.1	24.3	28.1
Years	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Oil price	36	50.6	61	69	94.4	61	77.4
Years	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Oil price	107.4	109.4	105.8	96.2	49.4	40.7	52.4
Years	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**
Oil price	69.7	64	41.4	69.8	100	82.9	79.8

Source: Prepared by researcher based on OPEC Annual Repports (2000-2024), www.opec.org

At the beginning of 2000, the OPEC basket price increased to USD 27.6 per barrel, driven by the accelerating pace of global economic growth and OPEC's move toward establishing prices in cooperation with producers outside the organization within a range of USD 22–28 per barrel. However, the collapse of the World Trade Center towers in New York caused oil prices to decline to approximately USD 26.20 per barrel in 2003, before reaching USD 50.6 per barrel in 2005 (Korso & Benbouziane, 2009, p. 47).This increase was driven by escalating conflicts and geopolitical tensions in the Middle East, Iran, Nigeria, and Venezuela, in addition to natural disasters that led to declining production and increased speculative activity in the international market, such as Hurricane Katrina (Dawod, 2018, p. 111).

These developments pushed oil prices to unprecedented record levels in mid-2008, reaching USD 140.43 per barrel as a result of a substantial increase in financial speculation on crude oil futures contracts. At the same time, signs of the global financial crisis began to emerge as a result of a series of collapses in financial markets which contributed to weakening the pace of economic growth followed by a decline in global demand for oil. Consequently, oil prices fell to approximately USD 94.4 per barrel by the end of 2008. However, the onset of the global economic recovery from the

financial crisis led to an increase in oil prices, which stabilized within a range of USD 107–109 per barrel during (2011-2012).

At the beginning of 2020, the global economy witnessed the spread of the novel coronavirus (COVID-19) beyond China, prompting countries to rapidly implement a series of strict preventive measures and precautions aimed at containing the pandemic. However, the crisis soon extended to the energy sector, causing a decline in the investment capacity of major companies and a reduction in their profits, in addition to the complete cessation of operations of most small energy companies as a result of their mounting debts. This resulted in disruptions to the fundamental market forces of supply and demand, causing oil prices to collapse (Arab Monetary fund, 2020, p. 114)

At the beginning of 2021, oil prices recorded a significant increase reaching USD 69.8 per barrel, as the international oil market began recovering from the repercussions of the novel coronavirus pandemic. Prices subsequently approached USD 100 per barrel in 2022. However, the escalation of the Russian-Ukrainian crisis caused unexpected fluctuations in the international oil and gas market as a result of disruptions to Russian supplies, given that Russia is the world's third-largest oil producer. This contributed to the decline in oil prices in 2023 and 2024 to approximately USD 82.9 per barrel and USD 79.8 per barrel, respectively.

3.2. Evolution of Public Expenditure Levels in Algeria During the Period (1990–2024):

Public expenditure in Algeria underwent significant developments during the period (1990–2024) which were closely associated with the structural imbalances affecting the national economy as a result of the economic policies adopted by the state within the framework of abandoning the socialist approach and transitioning toward a market economy in pursuit of its intended economic and political objectives. Public expenditure therefore passed through various stages, during which its levels experienced both increases and decreases.

a. Period (1990–1999): During this period, the Algerian state began implementing economic reform measures by turning to international financial institutions, particularly the International Monetary Fund in order to obtain the financial resources necessary to finance public expenditure and prepare for the transition toward a market economy. This process included the conclusion of several agreements including the Stand-By Arrangement and structural reforms. During this stage, public spending witnessed a significant increase, rising from DZD 136.5 billion in 1990 to DZD 759.5 billion in 1995 representing an increase of approximately 41.24%. This increase was attributable to the public authorities' adoption of a set of measures including the establishment of the social safety net, the financing of deficits affecting public institutions as a result of the growing prevalence of corruption in public-sector institutions, and the implementation of a financial restructuring program for public enterprises. In 1996, total public spending reached DZD 724.6

billion, with an annual growth rate of approximately -4.60%. This decline was attributable to the adoption by the Algerian authorities of a contractionary fiscal policy within the framework of the structural adjustment program supervised by the International Monetary Fund. Public spending subsequently stabilized at approximately DZD 961.7 billion in 1999, with an annual growth rate of 9.78%.

Table (2): evolution of public expenditure in Algeria during the period (1990–2024)

Years	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**
Public Spending	136.5	212.1	42.1	476.6	566.3	759.6	724.6
Growth rate (%)	-	55.38	98.06	47.04	18.82	34.18	4.60-
Years	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**
Public Spending	845.1	876.0	961.7	1221	1550.6	1960.2	1891.8
Growth rate (%)	16.62	3.65	9.78	26.99	17.33	26.41	3.48-
Years	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Public Spending	2052	2453	3108.5	4191	1321	4191	4466.9
Growth rate (%)	8.46	19.54	26.72	37.82	68.69	217.25	6.58
Years	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Public Spending	5853.6	7058.1	6024.2	6995.7	7656.3	7297.4	7282.6
Growth rate (%)	31.04	2057	14.64	16.12	4.20	4.68-	0.20-
Years	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**
Public Spending	7732	7741.3	6902.8	7436.1	9935.7	12142	13262.7
Growth rate (%)	6.17	0.12	12.14-	7.72	33.61	22.20	9.22

Source: Prepared by researcher based on National Office of Statistics Statistical Compendium (1960-2020),www.ons.dz

b. Period (2000–2014): This period was characterized by an increase in the level of public spending as a result of the recovery of oil prices in the international market and the growth of petroleum tax revenues. Public spending increased from DZD 1,321 billion in 2000 to DZD 6,995.7 billion in 2014, with an average growth rate of 24.70% over the period, reaching its highest growth rate in 2007 at approximately 37.82%. This increase resulted from the expansion of

public spending by the Algerian authorities following the rise in petroleum tax revenues, which was reflected in the state's implementation of four major investment programs, namely the Economic Recovery Program (2001–2004), the Complementary Program to Support Economic Growth (2005–2009), and the Program for the Continuation of Support for Economic Growth for the period (2010–2014).

c. Period (2015–2020): This period witnessed a decline in the volume of public spending compared with the preceding period. Public expenditure decreased from DZD 7,656.3 billion in 2015 to DZD 7,355.3 billion and then to DZD 7,297.4 billion in 2016 reaching DZD 7,282.6 billion in 2017. It recorded a negative annual growth rate of approximately (-2.14%) during the period extending from 2015 to 2017, as the authorities began implementing a set of measures, in addition to suspending the implementation of the five-year program for the period (2015–2019).

At the beginning of 2018, oil prices recovered in the international market, which enhanced the state's financing capacity and contributed to raising the level of public expenditure to DZD 7,732.0 billion with an estimated annual growth rate of 6.17%. However, public spending subsequently declined again to DZD 6,902.8 billion in 2020, with a negative growth rate of approximately (-12.14%). This decline was attributable to the depletion of foreign exchange reserves, which fell to approximately DZD 62 billion in February 2020.. The state utilized these reserves in an attempt to maintain the stability of the national economy and contain the spread of the novel coronavirus, which caused an almost complete paralysis of the global economy.

d. Period (2021–2024): During this period, public spending followed an upward trend, in contrast to the preceding period increasing from DZD 7,436.1 billion in 2021 to DZD 9,935.7 billion in 2021 and subsequently reaching approximately DZD 13,262.7 billion in 2024. This increase was driven by the growth in petroleum tax revenues resulting from the rise in oil prices in the international market. The annual growth rate of public spending during the period (2021–2024) was estimated at 18.18%.

4. Econometric Study:

In order to examine the impact of oil price fluctuations on public spending in Algeria during the period (1990–2020), an econometric model was developed comprising two independent variables and one dependent variable, represented by public expenditure. The model was estimated and analyzed using the Autoregressive Distributed Lag ARDL methodology and the statistical software EViews 12. The study data were obtained from the World Bank database, the National Office of Statistics ONS and the annual reports of the Bank of Algeria. The mathematical specification of the model is as follows:

$$\mathbf{GS = } f\mathbf{(PP, GDP)} \ldots\ldots(1)$$

The econometric model takes the following form:

$$\Delta \ln GS_t = \alpha_0 + \alpha_1 \sum \Delta \ln PP_{t-1}^{n} + \alpha_2 \sum GDP_{t-1}^{n} + + \alpha_3 ECM_{t-1} + \varepsilon_t \quad \text{.....(2)}$$

Where:

GS: represents public spending, measured at current prices in the local currency (Algerian dinar).

PP: represents the OPEC basket price, measured in US dollars.

GDP: represents gross domestic product as an indicator of economic growth, measured at current prices in the local currency.

4.1.Stationary Analysis of the Time Series:

To determine the degree of integration of the variables included in the econometric model under study unit root tests were conducted on the time series using two main tests, namely, the Augmented Dickey-

Fuller test and the Phillips-Perron test, under the three specifications of the unit root test and based on two hypotheses. The null hypothesis H0 states that the time series contains a unit root and is therefore non-stationary, whereas the alternative hypothesis H1 states that the time series does not contain a unit root and is therefore stationary. The results of the Augmented Dickey-Fuller and Phillips-Perron tests presented in the above table indicate that the time series for both public spending (GS) and gross domestic product (GDP) are stationary in level (at the 5%.10% significance levels), meaning that they are integrated of order zero, I(0). In contrast, the time series for oil prices (PP) is non-stationary in level, indicating the presence of a unit root.However, it becomes stationary after taking the first differences(at the 1% significance level).at Since the time series of the study variables are stationary at levels in some cases and at first differences in others, the Autoregressive Distributed Lag (ARDL) methodology can therefore be applied. The results of the Phillips-Perron and Dickey-Fuller tests are presented in the following table:

Table (3): results of unit root test

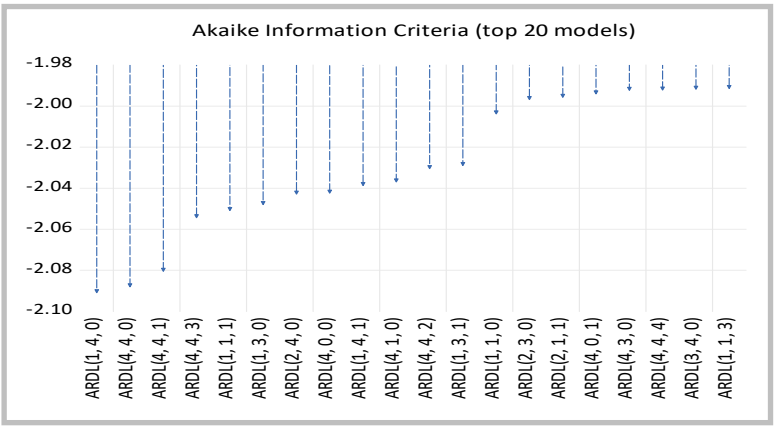
The Augmented Dickey-Fuller test (ADF)						
	Atlevel			**At First Difference**		
Variables	**Intercept**	**Trend &intercept**	**None**	**Intercept**	**Trend &intercept**	**None**
	Prob	**Prob**	**Prob**	**Prob**	**Prob**	**Prob**
LnGS	0.0170	0.0380	1.0000	/	/	/
LnPP	0.6869	0.5369	0.8331	0.0000	0.0004	0.0000
LnGDP	0.0180	0.0854	1.0000	/	/	/
Philips-Perron test (PP)						
	Atlevel			**At First Difference**		
Variables	**Intercept**	**Trend &intercept**	**None**	**Intercept**	**Trend &intercept**	**None**
	Prob	**Prob**	**Prob**	**Prob**	**Prob**	**Prob**
LnGS	0.0225	0.0515	0.9994	/	/	/
LnPP	0.7277	0.4701	0.8634	0.0001	0.0004	0.0000
LnGDP	0.0002	0.0360	1.0000	/		/

Source : E-views 12 program output

4.2. Determination of the Optimal Lag Length of the Model:

Several statistical criteria are used to determine the optimal lag length, including the Hannan-Quinn Schwarz, and Akaike criteria. These criteria aim to minimize the sum of squared residuals to the lowest possible value. In the present study, however, the Akaike Information Criterion (AIC) was adopted, which selects and proposes the 20 best econometric models from among 2,500 models. The results indicate that the optimal lag structure for the model is ARDL (1,4,0), as illustrated in the following figure:

Fig(1) : AIC graphics values



Source:E-views 12 program output

4.3. Bounds Test for Cointegration:

After determining the optimal lag lengths for the independent and dependent variables of the model, the cointegration test was conducted to determine the nature of the relationship among the model variables. The Bounds Testing approach is based on two hypotheses. The null hypothesis states that there is no cointegration among the variables, whereas the alternative hypothesis assumes the existence of a cointegrating relationship among the model variables. The null hypothesis is accepted if the calculated F-statistic is lower than the critical value at the lower bound, whereas the alternative hypothesis is accepted if the calculated F-statistic exceeds the critical value at the upper bound. The hypotheses are formulated as follows:

- **Null hypothesis H0**: No cointegration;

- **Alternative hypothesis H1**: Cointegration exists;

The results of the cointegration test presented in the table show that the F-statistic is estimated at 16.31075, which is higher than both the lower and upper bounds at the significance levels of 1% 2.5%, 5% and 10%. Accordingly, the null hypothesis is rejected and the alternative hypothesis is accepted, confirming the existence of a long-run equilibrium relationship between the independent variables and the dependent variable of the model.

Table (4): results of bounds test

F-Bounds Test	**Null Hypothesis: No levels relationship**			
Test Statistic	**Value**	**Signif.**	**I(0)**	**I(1)**
Asymptotic: n=1000				
F-statistic	16.31075	10%	2.63	3.35
K	2	5%	3.1	3.87
/	/	2.5%	3.55	4.38
/	/	1%	4.13	**5**

Source: E-views 12 program output

4.4. Diagnostic Tests of the Model:

The diagnostic testing stage is undertaken to assess the validity and overall adequacy of the econometric model before proceeding to estimate its parameters in both the short and long run. The diagnostic tests include the following:

a. Ramsey RESET Test for the Functional Form of the Model:

The results of the Ramsey RESET Test indicate that the probability associated with the t-statistic is 0.1558, which is greater than the 5% significance level. Similarly, the probability associated with the F-statistic is 0.1558, which also exceeds the 5% significance level. Furthermore, the likelihood probability is likewise greater than 5% reaching 0.0884. Accordingly, the null hypothesis stating that the functional form of the model is correctly specified is accepted, while the alternative hypothesis is rejected.

Table (5): results Ramsey RESET test

Ramsey RESET Test
Equation: UNTITLED
Omitted Variables: Squares of fitted values
Specification: LNGS LNGS(-1) LNPP LNPP(-1) LNPP(-2) LNPP(-

3) LNPP(-4) LNGDP C			
/	**Value**	**Df**	**Probability**
t-statistic	**1.469686**	**22**	**0.1558**
F-statistic	**2.159976**	**(1, 22)**	**0.1558**
Likelihood ratio	**2.903302**	**1**	**0.0884**

Source: E-views 12 program output

b. Breusch-Goldfrey Serial LM Test for Serial Correlation of the Residuals:

The test results presented in the table show that the **Prob Chi-Square** value is 0.2604, which is greater than the 5% significance level. Accordingly, the alternative hypothesis stating that serial correlation exists among the random errors is rejected, while the null hypothesis is accepted. It can therefore be concluded that there is no serial correlation.

Table (6): results Breusch-Godfrey Serial Correlation LM Test

Breusch-Godfrey Serial Correlation LM Test:			
Null hypothesis: No serial correlation at up to 2 lags			
F-statistic	0.998038	**Prob. F(2,21)**	0.3854
Obs*R-squared	2.690823	**Prob. Chi-Square(2)**	0.2604

Source : Eviews 12 program output

c. Heteroskedasticity Test ARCH:

The test results presented in the table show that the **Prob. Chi-Square** value is 0.8026, which is greater than the 5% significance level. Accordingly, the alternative hypothesis stating that heteroskedasticity exists in the error term is rejected, while the null hypothesis stating that there is no heteroskedasticity in the error term, or that the variance of the random error term is constant, is accepted.

Table(7): results of Heteroskedasticity Test: ARCH

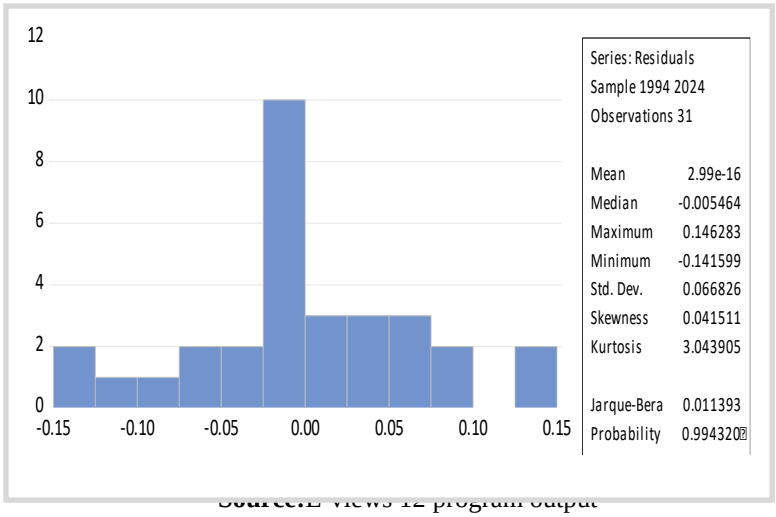
		Heteroskedasticity Test: ARCH	
F-statistic	0.058474	**Prob. F(1,30)**	0.8107
Obs*R-squared	0.062520	**Prob.Chi-Square(1)**	0.8026

Source : E-views 12 program output

d. Jarque-Bera Test for the Normal Distribution of Random Errors:

The test results indicate that the **Jarque-Bera** statistic is estimated at **0.011393**, while the corresponding probability value is **0.994320**which is greater than the 5% significance level. Accordingly, the alternative hypothesis stating that the model follows a normal distribution is accepted, while the null hypothesis stating that the model suffers from a normality problem is rejected. Therefore, the study model follows a normal distribution.

Fig (2): results of Jarque-Bera test



Source:E-views 12 program output

4.5.Model Estimation:

The model under study is estimated in both the long and short run.

a. Estimation of the Short-Run Relationship within the Error Correction Model

The results of the short-run relationship are presented in the following table:

Table (8): Estimation of the Short-Run Relationship

ECM Regression				
Case 2: Restricted Constant and No Trend				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
D(LNPP)	-0.066919	0.058740	-1.139244	0.2663
D(LNPP(-1))	-0.158368	0.066384	-2.385644	0.0257
D(LNPP(-2))	-0.140532	0.055457	-2.534057	0.0185
D(LNPP(-3))	-0.101209	0.055350	-1.828523	0.0805
CointEq(-1)*	-0.760094	0.088507	-8.587955	0.0000

Source:E-views 12 program output

The results of estimating the short-run relationship among the model variables within the **ECM** framework indicate the existence of a significant negative relationship between oil prices and public spending at the 5% significance level. In other words, a 1% increase in oil prices leads to a decrease in public spending by -0.086984. This can be explained by the fact that oil revenues are not immediately allocated to public expenditure, particularly when the state adopts an austerity-oriented fiscal policy due to prolonged declines in oil prices or during periods of structural reform.

The results of estimating the short-run relationship also show that the error correction coefficient **cointEq(-1)**, has a value of **-0.760094**, which is negative and statistically significant at the 1% level. This indicates the existence of a long-run relationship among the study variables and reflects the adjustment process toward equilibrium. Specifically, 0.76 of the disequilibrium is corrected over time to restore the equilibrium position. In other words, the dependent variable, represented by public spending, requires 0.770525/1 = 1.297 in the short run to return to its long-run equilibrium position. Accordingly, when public expenditure deviates from its equilibrium value in the short run during period (t-1), approximately 76% of this deviation is corrected during period (t).

b. Estimation of the Long-Run Relationship:

The results of estimating the long-run relationship are presented in the following table:

Table (9): Estimation of the Long-Run Relationship

Levels Equation				
Case 2: Restricted Constant and No Trend				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
LNPP	0.307994	0.072156	4.268430	0.0003
LNGDP	0.862349	0.052020	16.57734	0.0000
C	-0.895111	0.262407	-3.411155	0.0024
EC = LNGS - (0.3080*LNPP + 0.8623*LNGDP - 0.8951)				

Source:E-views 12 program output

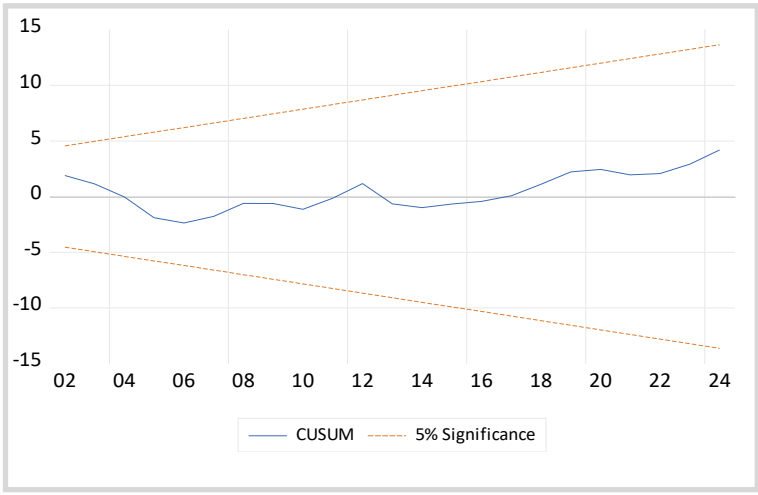
The results indicate the existence of a significant positive relationship between oil prices and public spending in the long run at the 1% significance level. Thus, a 1% increase in oil prices leads to an increase in public expenditure by 0.307994%. This is consistent with economic theory. This relationship can be explained by the fact that an increase in oil prices in the international market leads to higher petroleum tax revenues, which, in turn, enables the state to expand public spending.

The results also indicate the existence of a significant positive relationship between gross domestic product and public spending at the 1% significance level. Thus, a 1% increase in gross domestic product leads to an increase in public expenditure by 0.862349%. This is consistent with economic theory**.** According to Wagner's Law, an increase in the rate of economic growth leads to an expansion of the state's involvement in economic activity. Consequently, the level of public spending increases by an amount greater than the increase in the average per capita share of gross domestic product. Moreover, an increase in the rate of economic growth contributes to higher aggregate demand resulting in increased public spending and, consequently, an increase in the revenues generated by economic growth.

4.6. Test of the Structural Stability of the Model:

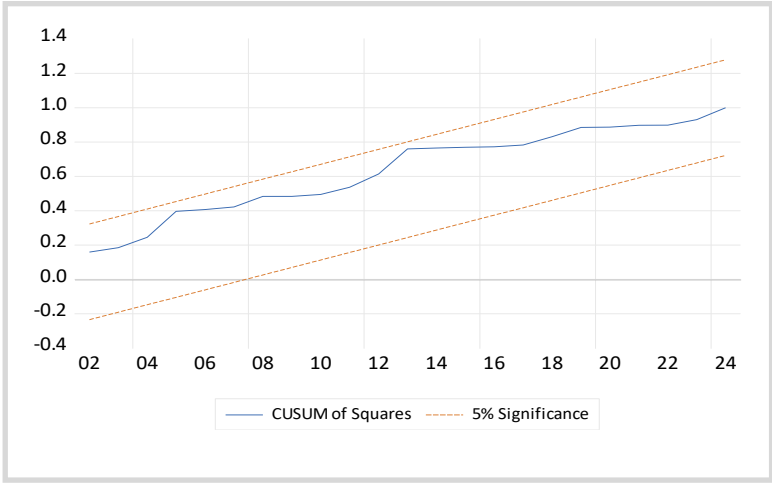
The analysis proceeds to assess the stability of the model through two principal tests: the **CUSUM** test, based on the cumulative sum of recursive residuals, and the **CUSUM SQ** test, based on the cumulative sum of the squares of recursive residuals. These tests are conducted to ensure that the study data are free from structural changes and to verify the consistency of the parameters estimated in the short run with those estimated in the long run. This condition is satisfied when the graphical curves of both tests remain within the critical bounds at the 5% significance level. The results of the two tests presented in Figures 3 and 4, indicate that the graphical curves of both the CUSUM test and the CUSUM SQ test lie within the critical bounds. Accordingly, the model parameters can be considered stable.

Fig (3) : plotting of the CUSUM test



Source:E-views 12 program output

Fig (4) : plotting of the CUSUM SQ



Source:E-views 12 program output

5. Conclusion:

This study examined the Relationship between Oil Price Volatility and Public Spending in Algeria during the Period (1990–2024) through an econometric analysis based on the Autoregressive Distributed Lag methodology. The study yielded a number of findings, which can be summarized as follows:

-The results of the Augmented Dickey-Fuller and Phillips-Perron tests presented in the above table indicate that the time series for both public spending (**GS**) and gross domestic product (**GDP**) are stationary at levels, indicating that they are integrated of order zero, I(0). In contrast, the time series for oil prices (**PP**) is non-stationary at levels, indicating the presence of a unit root however, it becomes stationary after taking the first differences. Since the time series of the study variables are stationary at levels in some cases and at first differences in others, the Autoregressive Distributed Lag (**ARDL**) methodology can therefore be applied.

-The results of the cointegration test presented in the table indicate that the **F-statistic** is estimated at **16.31075**, which exceeds both the lower and upper bounds at the significance levels of **1%, 2.5%, 5%, and 10%**. Accordingly, the null hypothesis is rejected and the alternative hypothesis is accepted confirming the existence of a long-run equilibrium relationship between the independent variables and the dependent variable of the model.

-The results of estimating the short-run relationship among the model variables within the **ECM** framework indicate the existence of a significant negative relationship between oil prices and public spending at the 5% significance level. Thus, a 1% increase in oil prices leads to a decrease in public expenditure by -0.086984. This can be explained by the fact that oil revenues are not immediately allocated to public spending, particularly when the state adopts an austerity-oriented fiscal policy in response to prolonged declines in oil prices or during periods of structural reform.

-The results of estimating the short-run relationship also show that the error correction coefficient, **cointEq(-1)**, is **-0.760094** which is negative and statistically significant at the 1% level. This indicates the existence of a long-run relationship among the study variables and demonstrates that 0.76 of the disequilibrium is corrected over time to restore equilibrium. In other words, the dependent variable, represented by public spending, requires 0.770525/1 = 1.297 in the short run to return to its long-run equilibrium position. Accordingly, when public spending deviates from its equilibrium value in the short run during period

(t-1) approximately 76% of the deviation is corrected during period (t).

-The results indicate the existence of a significant positive relationship between oil prices and public spending in the long run at the 1% significance level. Thus, a 1% increase in oil prices leads to an increase in public expenditure by 0.307994%. This can be explained by the fact that higher oil prices in the international market lead to increased petroleum tax revenuesthereby enabling the state to expand public spending.

-The results indicate the existence of a significant positive relationship between gross domestic product and public spending at the 1% significance level. Thus, a 1% increase in gross domestic product leads to an increase in public expenditure by 0.862349%.

6. Recommendations:

-Optimizing the management of petroleum tax revenues and directing them toward financing productive economic sectors particularly the industrial and agricultural sectors.

-Enhancing the efficiency of public expenditure and establishing the principles of good governance in public financial management, while combating administrative corruption and the misappropriation of public funds by strengthening the supervisory role of financial authorities over public funds and reforming the public budget system.

-Diversifying sources of national income by seeking to increase ordinary tax revenues and gradually replacing petroleum taxation with these revenues, in addition to combating tax evasion and developing revenues generated outside the hydrocarbon sector in order to reduce dependence on the oil sector.

-Adopting an economic diversification strategy aimed at developing productive economic sectors and achieving high growth rates outside the hydrocarbon sector, with the objective of reducing dependence on the oil sector and transitioning toward a post-oil economy.

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