

IMPACT OF THE HYDROCARBON SECTOR ON PUBLIC SPENDING IN ALGERIA: AN ECONOMETRIC ANALYSIS

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ABSTRACT

The hydrocarbons sector constitutes the driving force of the Algerian economy. It is considered the main source of national revenue, ensuring the financing of expenditures across most strategic sectors. This article analyzes the impact of the hydrocarbons sector on the trends in public spending in Algeria from 1980 to 2023. The analysis relies on an econometric approach (the VECM model), which makes it possible to examine the short-term behavior of the variables as well as the long-term equilibrium dynamics. The results of the study reveal that oil taxation has a significant positive impact on public expenditures. In other words, an increase in fiscal revenues from the oil sector leads to higher public spending. Conversely, the relationship between hydrocarbon exports and public expenditures is negative. This suggests that an increase in exports does not immediately translate into higher public spending, due to the existence of budget stabilization mechanisms. The study also showed that oil price and exportation do not contribute to explaining the behavior of public expenditures either in the short term.

KEYWORDS: Algeria, exports, oil, public expenditures, VECM

1. Introduction

In Algeria, the economic role of the State is highly significant, as public spending is considered the most powerful lever of fiscal policy used to stimulate national economic activity. However, the volume of public expenditure remains

dependent on the availability of resources from the hydrocarbon sector, which currently generates nearly two-thirds (2/3) of budget revenues. Oil revenues, in turn, are closely correlated with both production levels and the price per barrel, which is set by the international market (Omrani &

Toumache, 2016). This raises serious concerns about the sustainability and vulnerability of fiscal policy, emerging as a major medium- and long-term issue. On 2024, the hydrocarbon sector accounted for 16.83% of GDP, 92.18% of exports, and 46.26% of budget revenues (Bank of Algeria, 2025). Despite the efforts undertaken and the programs adopted by the State to revive the national economy and reduce dependence on the hydrocarbon sector in order to diversify income sources and improve employment prospects, the unemployment rate remains high, reaching 12.7% in 2023, particularly among young people (Word Bank Group, 2025).

It is true that the recession experienced by the global economy following the COVID-19 health crisis slowed down growth in Algeria. However, the recovery in oil prices on the world energy market helped to give a new boost to the national economy, leading to a significant increase in export revenues on the one hand. On the other hand, this rise was accompanied by an increase in current expenditures, particularly wages and pensions in the public sector, the higher cost of the new unemployment benefit system, as well as the expansion of food subsidies (African Development Bank Group, 2024). However, this period of prosperity did not last long. By the end of 2024, the state recorded a decline in public spending of about 22.66%, due to a 31.1% drop in oil revenues, accompanied by an increase in imports of goods (Bank of Algeria, 2025). This reflects the great fragility of the economy in the face of external shocks.

In light of this, the purpose of our research is to highlight the place of the hydrocarbon sector in Algeria's fiscal expansion. Thus, we seek to answer the central question: To what degree do variations in hydrocarbon sector affect the financing mechanisms of Algeria's national economic activity?

To address this issue, we analyzed data covering the period from 1980 to 2023 using a VECM cointegration model. Through this model, we can analyze the interactions between key macroeconomic variables namely exports, price, oil rent, and the taxation in order to identify the impact of the hydrocarbon sector on public expenditure in Algeria.

Finally, this research will provide concrete insights and strategic recommendations aimed at increasing existing production capacities and diversifying public sector financing sources in Algeria, with the objective of reducing its dependence on the hydrocarbon sector.

2. Literature Review

The correlation between the variables of our study (oil revenue, public expenditure and economic growth) has been widely explored in the literature, particularly in oil-dependent economies. Rahal and Amieur (2024) focus on Algeria's persistent reliance on hydrocarbons between 2000 and 2022, highlighting how fluctuations in oil prices significantly impact public finances and budgetary stability. Using a VAR model, the results of the study revealed that oil prices affect budget expenditures in the short term, highlighting the fragility of the Algerian economy to external oil shocks despite efforts toward economic diversification. Similarly, Saidi (2023) studied the impact of oil shocks on economic growth in Morocco via public spending. Although direct effects of oil prices on growth are evident, the study concludes that public spending does not serve as a transmission channel, suggesting a more complex relationship between resource volatility and economic performance. The institutional context is emphasized by Moussa et al. (2022), who investigates CEMAC countries from 1996 to 2017. He proved that oil revenue variations have a positive and significant

short-term impact on public spending. Moreover, Moussa highlights the role of governance, arguing that better institutional quality strengthens the positive effects of oil price increases, thus pointing to governance as a critical mediator in resource management. In the case of Nigeria, Aregbeyen and Kolawole (2015) explore the causality between oil revenues, public expenditure, and economic growth from 1980 to 2012. Using cointegration and VECM techniques, they demonstrate that oil revenues drive both public spending and growth, but find no evidence of a causal relationship from public spending to economic growth, raising concerns about the effectiveness of fiscal policies financed by oil rents. Alkhateeb et al. (2017) extend the analysis to Saudi Arabia (1991-2016), adding employment as a variable.

Their results reveal cointegration between oil revenues, GDP, public spending, and employment levels, suggesting that dependence on oil revenues directly affects labour market dynamics. They stress the urgent need for economic diversification to mitigate these vulnerabilities. The political implications of oil dependence are further explored by Hong (2017), who examines authoritarian regimes and notes that the neglect of the oil sector has led to lower levels of spending related to education and health. His analysis shows that this negative effect is specific to authoritarian contexts and absent in democratic regimes, highlighting the political economy dimension of resource wealth. Jordao da Silva (2021) introduces the notion of institutional path dependence to explain the use of oil royalties. His study emphasizes that resource management practices are often resistant to change and are deeply influenced by past institutional arrangements. This insight suggests that improving the quality of public spending requires not only technical reforms but also a break from entrenched institutional behaviors.

Finally, Dizaji (2024) focuses on Middle Eastern oil rentier states, analyzing how negative oil shocks affect military spending and democratization processes. His findings suggest that reductions in oil revenues lead to lower military expenditures and eventually improve the quality of democracy, although these effects take time to materialize due to governments' initial resistance to spending cuts. Together, these studies highlight the multifaceted consequences of hydrocarbon dependence, stressing the crucial roles of governance quality, institutional reforms, and economic diversification in achieving fiscal stability and sustainable development in resource-rich economies.

3. Material and Methods

Oil is considered an economic resource of great importance, as it is a strategic product for the countries that produce and export it, and a major contributor to economic growth and social development in these countries. It is also regarded as a key source of financing for the state budget, generating foreign currency inflows to fund national budgets and supporting the balance of payments. This creates a close relationship between oil exports and public expenditures in these countries (Kadjaji, 2017).

The purpose of this paper is to determine the effect of hydrocarbon sector on government spending in Algeria by using tests and a VECM model over the period 1980-2023. This is carried out with the help of a software program called EViews 12.0. The data used for the analysis were collected from an international database and articles: national accounts data from the World Bank and national accounts files (Oudai, 2022; Gnadza, 2011; Mahtal, 2025; Abdelmalek, 2020; Belouafi, 2017), OPEC reports, Bank of Algeria, artificial intelligence (chatgpt). The data are on an annual basis. We will

present the variables that were retained for our empirical analysis:

➤ **Public spending:** Represents the total public spending in Algeria in millions of dollars.

➤ **Hydrocarbon exports:** Represents the total hydrocarbon exports in millions of tonnes.

➤ **Hydrocarbon tax:** Represents oil taxation in millions of dollars.

➤ **Oil price:** in dollars.

➤ **Oil rents:** as a share of GDP.

The selection of this model is supported by its use in numerous similar studies to explain long- and short-term relationships between variables. The purpose of using these econometric methods is to minimize the risk of spurious regressions. Our analysis first checks the stationarity of the variables using the

Augmented Dickey-Fuller (ADF) test, and then applies Johansen's cointegration test to detect long-term equilibrium relationships and short-term dynamics.

4. Results

In this part, econometric methods are employed to analyze the relationships among the variables, along with appropriate economic commentary.

4.1. Study of the Stationarity of the Series

As part of our analysis, we perform the ADF test to evaluate the stationarity of public expenditure (as an endogenous variable) and its fundamental explanatory variables. The table below provides the results of the stationarity test:

Table no. 1
Augmented Dickey-Fuller Test

ADF		Level	First Différence
		Prob	Prob
Ln EXP	Intercept	0.8575	0.0001***
	Trend and intercept	0.8766	0.0006***
	None	0.9867	0.0000***
Ln EXPORT	Intercept	0.2269	0.0000***
	Trend and intercept	0.1374	0.0000***
	None	0.9969	0.0000***
Ln OP	Intercept	0.7031	0.0000***
	Trend and intercept	0.3193	0.0002***
	None	0.7468	0.0000***
Ln TAX	Intercept	0.7132	0.0000**
	Trend and intercept	0.4349	0.0000***
	None	0.8549	0.0000***
Ln OR	Intercept	0.2209	0.0000***
	Trend and intercept	0.3644	0.0001***
	None	0.5952	0.0000***

*, ** & *** refers to the rejection at 10%, 5% & 1%

(Source: Authors-generated tests conducted using the EVIEWS 12 software)

ADF test results reveal that public expenditures, oil prices, exchange rate, taxation, and hydrocarbon exports exhibit unit roots in levels but become stationary after first differencing. This finding

suggests the existence of a potential long-run equilibrium relationship (cointegration) among the variables.

4.2. Study of Multivariate Cointegration (Johansen Approach)

4.2.1. Cointegration Test

Before looking for a long-term relationship between the variables, we must first verify its existence. To do so, we used

Johansen's cointegration test. To do so, we must first determine the number of lags (p) using the VAR model. The information criteria LR, FPE, and AIC lead to the choice of lag ($P = 2$).

Table no. 2
Determination of the Number of Lags P

Lag	LogL	LR	FPE	AIC	SC	HQ
0	38.48519	NA	$1.34e^{-07}$	-1.633424	-1.424452	-1.557328
1	206.7821	287.3363*	$1.25e^{-10*}$	-8.623519	-7.369686*	-8.166942*
2	232.4276	37.52990	$1.28e^{-10}$	-8.655004*	-6.356310	-7.817946
3	245.3847	15.80139	$2.68e^{-10}$	-8.067547	-4.723992	-6.850009

(Source: Authors-generated tests conducted using the EVIEWS 12 software)

Then, we will apply the Maximum Eigenvalue test to determine the number of existing relationships:

Table no. 3
Test of Maximum Eigenvalue

	Hypothesized No. Of CE(s)	Eigenvalue	Trace Statistic	0.01 Critical Value	Prob.**
	None*	0.552817	83.07423	77.81884	0.0030
At most	1	0.433416	50.07794	54.68150	0.0304
	2	0.252741	26.78464	35.45817	0.1070
	3	0.197489	14.83958	19.93711	0.0626
	4	0.132319	5.819190	6.634897	0.0158
	5	0.552817	83.07423	77.81884	0.0030

(Source: Authors-generated tests conducted using the EVIEWS 12 software)

The results of the above test show that there exists one relation of cointegration between the variables in our study. The analysis indicates that the first eigenvalue is greater than its critical value at the 1% level ($83.07 > 0.5528$).

4.2.2. Estimation of the Long-Term Relationship

The Johansen cointegration test revealed the existence of one cointegration

$$\text{LN_EXP} = -7.131376 \text{ EXPORT} + 4.425698 \text{ TAX} - 2.923228 * \text{LN_OP} \\ - 3.592614 * \text{LN_OR} + 3.424558$$

Discussion: The results show that oil prices have a negative and significant effect on public spending in Algeria. When oil prices decrease, public spending increases, which contradicts economic theory. This is due to the deficit experienced in the budget

relationships among the variables considered in our study. However, the analysis will focus solely on the first relationship, which highlights the link between public spending and a set of explanatory variables, namely taxation, the exchange rate, oil rent, hydrocarbon exports, and the oil price.

balance over several periods, beginning in 1999. The deficit at that time was the result of declining oil prices, reduced revenues generated from oil, and debt servicing costs. During the period between 2009 and 2014, the general budget also recorded a

deficit in its balance, despite rising oil prices. This was mainly due to the scale of the development programs implemented by Algeria and the miscalculation of implementation costs, which led to an increase in public expenditures. The deficit continued during the following two years, 2015/2016, as a result of rising expenditures caused by the allocation of additional funds to projects that had not been completed within previous programs, on the one hand, and, on the other hand, due to the decline in oil prices and Algeria's commitment to reduce its production quota. The main reason behind the deficit in the 2019/2020 budget was the drop in oil prices resulting from the global lockdown caused by the COVID-19 pandemic, which led to reduced revenues from the sector and, consequently, a decline in overall public revenues. At the same time, public expenditures increased as Algeria adopted policies such as the layoff of half the workforce, rising costs of medical equipment, and compensation for groups affected by the pandemic (Rahmani Ali, 2022). Anis Ali (2021) found the same results and showed that, although oil prices decline in Saudi Arabia, government spending increases in the long term. Likewise, Ebaid (2016) demonstrated that oil prices negatively affect consumption expenditure.

In Algeria, oil taxation has a positive impact on public spending. Given the specific characteristics of the Algerian case, the hydrocarbons sector plays a central role in the economy in general, and petroleum taxation in particular has a direct impact on public revenues, which in turn determines the pattern of public spending (Bourennane & Ouledlaid, 2020). Petroleum taxation was

able to fully finance capital expenditures during the period 1999-2005. However, its role in covering these expenditures declined during the period 2006-2012 due to the implementation of economic recovery programs. At the same time, petroleum taxation remained unable to cover current expenditures throughout the rest of the study period because of the sharp increase in such expenditures and the oil crisis experienced by Algeria in 2013. Moreover, the COVID-19 pandemic significantly worsened this deficit, as the collapse in oil demand and prices revealed the fragility of the Algerian economy, which suffers from structural imbalances and weak economic infrastructure. This situation has rendered the national economy highly vulnerable to external shocks (Boutayeb & Ghazazi, 2019).

In the long term, hydrocarbon exports effect negatively on public expenditure.

The results show that petroleum rent affect negatively on public expenditures in the long run. Despite the contribution of ordinary taxation in covering public expenditures, oil revenues remain dominant in ensuring financial stability, which reinforces the dependence of fiscal policy on global oil price fluctuations and highlights the continued fragility of the economy despite diversification efforts (Rahal & Amieur, 2024).

4.2.3. Estimation of the VECM Model

The short-term equation of public spending ($D(LN_EXP)$) describes the adjustment process toward long-term equilibrium as well as the impact of past variations in budgetary and oil-related variables. It is formulated as follows:

$$\begin{aligned} D(LNEXP) = & -0.168964973668*(LNEXP(-1) - 7.13137594578*LNEXPORT(-1) - \\ & 2.92322770063*LNOP(-1) - 3.59261443062*LNOR(-1) + 4.4256976716*LNTAX(-1) + \\ & 3.42455791151) - 0.0863427522623*D(LNEXP(-1)) - 0.0347650547042*D(LNEXP(-2)) - \\ & 1.45137138646*D(LNEXPORT(-1)) - 1.63686642313*D(LNEXPORT(-2)) - \\ & 0.179179857605*D(LNOP(-1)) - 0.108404280924*D(LNOP(-2)) - \\ & 0.568774308503*D(LNOR(-1)) - 0.306945257702*D(LNOR(-2)) + \\ & 0.632440977704*D(LNTAX(-1)) + 0.340123360033*D(LNTAX(-2)) + 0.0643295459439 \end{aligned}$$

The coefficient of the error correction term is negative (-0.1689) and significant at the 5% level, indicating that 16.89% of the deviations are corrected in each period. This means that fiscal imbalances quickly return to equilibrium.

The results showed that petroleum taxation also has a positive effect on government expenditure in the short term, as fiscal policy is considered one of the tools of public intervention. Governments often resort to it either to reduce social inequalities or to stimulate economic activity (Zatla & Djelil, 2015).

Oil rent negatively affects public expenditure in the short and long term, which can be attributed to the mismanagement of oil revenues in financing certain infrastructures and non-productive sectors. This may result in significant repercussions on both the social and security levels (Alouache et al., 2022).

Our study shows that variables (oil prices and exportation) do not have any effect on public spending in Algeria in the short term. Ouarda Alouache et al. (2022) attributed this to several reasons: *“The significant level of social transfers in Algeria is financed by revenues derived from oil sales as part of the redistribution of rent. In addition, foreign currency earnings from oil sales mainly finance Algeria’s imports, but they are largely composed of finished products intended for direct consumption. Finally, the phenomenon of corruption reached a very high level in Algeria, with massive embezzlement of public funds”*.

5. Conclusions

The results from the Vector Error Correction Model (VECM) provide relevant insights into the structural and short-term dynamics between public expenditure and key macroeconomic variables in Algeria. In the long run, the cointegration equations highlight a stable link between public expenditure, taxation,

oil revenues, and the exchange rate. This underlines the strong interdependence between fiscal performance and external economic conditions, particularly those related to the hydrocarbon sector.

The coefficients for taxation and indicate that tax revenues are a relatively stable source of budgetary financing in long and short term. This finding underscores the importance of in-depth tax reform, focused on broadening the tax base, improving compliance rates, and combating tax evasion, with a view to strengthening the long-term sustainability of public finances. Furthermore, oil profitability has a negative long-term effect on public spending. This phenomenon is explained by the budget deficits recorded since 1999, because of the decline in oil prices, the decrease in oil revenues, as well as debt service costs.

The results also show that public spending is not only influenced by oil prices, but also by other economic factors (such as inflation and exchange rates), social factors (such as unemployment), and historical spending trends. According to Rahal & Amieur (2024), this makes budget management more difficult and complex, which requires the implementation of reforms in order to stabilize the situation.

These findings argue for a strategic overhaul of Algeria’s fiscal policy. First, economic diversification appears to be a priority to reduce the country's structural vulnerability to hydrocarbon-related shocks. Developing a competitive industrial sector, modernized agriculture, and high value-added services would broaden the national production base and create alternative sources of income.

Second, ambitious tax reform is needed to ensure the predictability and resilience of public finances in the long term. This involves digitizing tax administration, strengthening control mechanisms, and gradually integrating the informal sector to broaden the tax base. Encouraging the contribution of non-oil

companies is essential to reconcile economic competitiveness and effective financing of public policies.

Third, oil revenues should be managed more strategically. Beyond hoarding, they should be mobilized through sovereign investment funds focused on infrastructure development, innovation, and sustainability. Such an approach would transform oil revenues into a lever for long-

term growth, rather than fuelling cycles of unsustainable spending.

Finally, better coordination between fiscal, monetary, and exchange rate policies is essential to mitigate the effects of dinar fluctuations on public finances. Stabilization mechanisms, import substitution policies, and the promotion of non-hydrocarbon exports would help limit the negative impacts of devaluations on household budgets and living standards.

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