

Public Financial Dependence on Algeria's Hydrocarbon Exports Revenues (2000-2022)

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Received: 16.07.2024
Available online: 20.12.2024

Abstract

This study explores hydrocarbon dependency in Algeria, focusing on oil price fluctuations' impact on public finance and fiscal policies from 2000 to 2022. Despite efforts to diversify revenue sources, hydrocarbon revenues remain central to Algeria's public finances. Energy market volatility introduces uncertainty, affecting budget stability and economic planning. Historical fuel price fluctuations have influenced fiscal policies, enabling development during high prices and necessitating austerity measures during declines. Using a Vector Autoregression (VAR) model, our analysis reveals a short-term influence of oil prices on fiscal expenditures. These findings underscore Algeria's vulnerability to global oil market shocks, impacting developmental policies and economic restructuring. This research contributes to understanding economic diversification in oil-dependent economies, illuminating public finance dependency on hydrocarbon and its implications for fiscal stability in Algeria.

Keywords: petroleum exports, budget, expenditure, public finance, fiscal policy, economic diversification, Oil Price Fluctuations, Algeria

JEL: E6, E62, H2, E3

Introduction

The dependence of public spending in hydrocarbon-dependent economies, such as Algeria, on oil price fluctuations is a focal point of economic inquiry, particularly in the

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context of global shifts towards energy transition and economic diversification. This paper embarks on a comprehensive analysis of how the volatility of oil prices has influenced Algeria's public finances over the period from 2000 to 2022. Amidst efforts by oil-exporting nations to reduce their hydrocarbon dependency, which forms the backbone of their state budgets and is a key driver of both public and private investments, Algeria's case offers insightful reflections on the broader implications of such dependency in the face of the energy market's inherent volatility.

Despite concerted efforts to broaden its revenue base, Algeria's economy remains intricately linked to the global oil market dynamics, resulting in fiscal policies that oscillate between expansion during periods of oil price surges and contraction in response to declines. This study employs an extensive econometric framework, including unit root tests, cointegration analysis, and Vector Autoregression (VAR) modeling, to delve into the temporal dynamics between oil revenues and public expenditures, thereby offering an understanding of the immediate and short-term fiscal ramifications of oil price changes.

The study strives to answer the following research questions:

1. To what extent does public spending in Algeria correlate with the volatility of oil prices? This question investigates Algeria's fiscal policy responsiveness to global oil price shifts, examining challenges in maintaining budgetary balance and macroeconomic stability in an oil-dependent economy, despite efforts at diversification.

2. What are the implications of hydrocarbon dependency for fiscal stability and economic diversification in Algeria? Considering the oil market's volatility, the study seeks to explore the broader consequences of Algeria's reliance on oil for its fiscal policy, economic planning, and long-term developmental objectives.

Literature overview

As a pivotal resource in the global economy, oil has been extensively studied for its impact on various economic variables. Algeria, with its significant reliance on the hydrocarbons sector, has experienced profound effects on its economic landscape, particularly evident in its public finances from the early 2000s to the present. This section synthesizes key studies examining hydrocarbon exports, public finances, and Algeria's endeavors to adapt to oil price fluctuations while diversifying its economy. This literature review meticulously traces the evolution of scholarly thought and empirical research surrounding the impact of oil price fluctuations on Algeria's economy and its diversification efforts. By adopting a chronological approach, we elucidate the progressive deepening of understanding in this field, anchored by the critical examination of 17 seminal studies.

In the early 2000s, Dillman (2002) explored the intricacies of Algeria's oil and gas policies through a review of Aissaoui's (2001) analysis, laying the groundwork for understanding the sector's foundational role in the country's economic and socio-political fabric. This period underscored the challenges of economic dependence on hydrocarbons, highlighting the need for strategic policy-making amidst budget constraints and political instability. The

narrative then transitions to El Anshasy and Bradley's (2012) investigation, which broadens the scope by exploring the nexus between oil prices and fiscal policy across oil-exporting nations, including Algeria. Their insights into the destabilizing effects of oil price volatility on fiscal structures set the stage for subsequent discussions on economic stability and diversification strategies.

The mid-2010s witnessed a surge in empirical research focusing on Algeria's economic vulnerabilities and the pursuit of diversification. Hidouchie and Aouil (2017) spotlighted the transient nature of economic improvements reliant on unstable oil revenues, critiquing the allocation of funds without fostering productive sectors. This period also saw Kaddouri and Bouaziz (2017) assess government initiatives like the FGAR, aimed at stimulating non-hydrocarbon investments, though challenges at various levels tempered the impact of such endeavors.

During this time, Bekhaled et al. (2024) provided a significant contribution by examining the effects of oil price fluctuations on public expenditures in Algeria between 1989 and 2019. Their study utilized the ARDL model to establish that oil price fluctuations had a significant and long-lasting effect on public spending, particularly highlighting the strong positive correlation between rising oil prices and increased public expenditures. This work adds to the understanding of how Algeria's heavy dependence on oil makes its fiscal policy highly sensitive to global oil market dynamics, reinforcing the need for fiscal reforms to mitigate these impacts.

As the decade progressed, scholars like Bouchaour and Al-Zeaud (2012), along with Elias Elhannani et al. (2016), further dissected the short-term and long-term ramifications of oil price distortions on macroeconomic indicators and the financial sector's role in cushioning the economy against oil revenue volatilities. These studies underscore the complex interplay between fiscal policies, the financial sector, and the overarching goal of economic diversification.

Contributing to this discussion, Maidi and Benhamida (2022) extended the analysis of oil price fluctuations, using econometric methods, including the Error Correction Model (ECM), to assess both the long-term and short-term effects on Algeria's public expenditures over the period from 1986 to 2020. They found a significant long-term correlation, affirming that fluctuations in oil prices have both immediate and sustained impacts on Algeria's fiscal policies. The study demonstrated how oil price declines trigger austerity measures, which have profound implications for public sector spending and broader economic stability.

Entering the late 2010s and early 2020s, the discourse evolved to encompass broader regional and global perspectives. Louglaithi and Dardouri (2019) and Camporeale et al. (2021) extended the analysis to the MENA region, advocating for renewable energy investments as a strategic pivot towards economic stability and diversification. Concurrently, Amroun (2021) revisited Algeria's rentier economy dynamics, emphasizing the nuanced role of OPEC and the implications of expansionary fiscal policies driven by hydrocarbon revenues.

Further advancing the empirical approach, Raki and Sedkaoui (2022) investigated the impact of oil price fluctuations on government spending in Algeria from 1983 to 2020, applying the ARDL self-regression model. Their findings demonstrated the long-term

relationship between oil prices and public spending, with government expenditures largely being a function of past oil prices, GDP, and exchange rates. This research reinforced the notion that Algeria's economic performance remains tied to global oil price trends, despite efforts at economic diversification.

The literature also casts a wider net to include comparative studies, such as Mohammad Farzanegan's (2009) exploration of Iran's challenges and Al Jabri et al. (2022) analysis of Oman's fiscal dynamics in response to oil price fluctuations. These studies, alongside Kangni R. Kpodar and Liu's (2021) investigation into the inflationary impact of fuel price increases, enrich the discourse by providing comparative insights and underscoring the universal challenges and strategies in managing oil-dependent economies.

Ross's (2019) examination of economic structures in oil-exporting countries, including Algeria, offers a critical reflection on the challenges of diversification in the face of entrenched oil dependency. This study, alongside Malik's (2007) focus on the implications of high oil prices for economies like Pakistan, encapsulates the broader thematic concerns surrounding efficient energy utilization, strategic planning, and the imperative of economic diversification.

In synthesizing these diverse yet interconnected strands of research, this literature review presents a comprehensive narrative that charts the evolution of scholarly understanding regarding Algeria's economic reliance on oil, the vicissitudes induced by oil price fluctuations, and the multifaceted strategies pursued toward economic diversification. This chronological organization not only highlights the progression of thought but also underscores the persistent themes and emerging insights that have shaped the academic discourse in this domain, facilitating a seamless narrative flow that guides the reader through the intricate tapestry of research surrounding the complex interplay between oil price dynamics and economic diversification in Algeria.

Methodology

This study adopts a comprehensive econometric approach to examine the relationship between public spending and oil price fluctuations in Algeria over the period 2000-2022. The analysis utilizes time series data, with the volume of public spending denoted as DEP and the international oil price as PRICE. The use of nominal values allows the analysis to capture the direct effects of price volatility on public spending.

- **Unit Root Testing:** The stationarity of the time series was assessed using the Phillips-Perron unit root test to ensure the reliability of subsequent analyses.
- **Vector Autoregression (VAR) Model:** A Vector Autoregression (VAR) model was selected to capture the short-term dynamics between the variables. The VAR(1) model was chosen based on criteria such as the Akaike Information Criterion (AIC), Schwarz Criterion (SC), and Hannan-Quinn Information Criterion (HQ).
- **Model Stability:** The stability of the VAR model was assessed through examination of the Inverse Roots of AR Characteristic Polynomial.

- **Residual Diagnostics:** Serial correlation of residuals was tested using the LM test to ensure the model's specification.
- **Homoscedasticity:** White's test was employed to examine the homoscedasticity of the residuals.
- **Jarque-Bera Test:** The Jarque-Bera test was utilized to confirm the normal distribution of the residuals.

The econometric methods employed adhere to rigorous time series analysis protocols, ensuring that a robust and methodologically sound foundation supports the subsequent sections of this study.

Results

Analysis of public spending evolution during the 2000-2022 period

Algeria's Keynesian economic model emphasizes public spending as a critical economic driver, especially given the private sector's limitations and a decline in foreign investment. To assess the public sector's influence, we analyzed public expenditure relative to GDP, which highlights an upward trajectory with some fluctuations. Public spending as a percentage of Gross Domestic Product (GDP) ranged from 73.11 % in 2006 to a peak of 114.18 % in 2016. This high proportion reflects Algeria's reliance on government expenditure to stimulate economic activity, including investments in social programs and private-sector loans to reduce unemployment and support entrepreneurship. Table 1 illustrates the progression of public spending throughout the study period.

Table 1. Total spending throughout the study period

Years	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Total National Expenditure (% of GDP)	78.72	85.33	90.13	85.63	85.59	76.87	73.11	77.80	80.74	100.58	92.98	89.90
Years	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	
Total National Expenditure (% of GDP)	91.62	97.20	101.52	113.35	114.18	110.06	106.34	106.38	110.39	99.73	88.37	

Source: World Bank (2024)

The rise in the public expenditure to GDP ratio observed from 2015 to 2020 can be attributed to two main factors. Firstly, the repercussions of the oil crisis, which began in mid-2014, led to a substantial decline in international oil prices. Secondly, the onset of the COVID-19 pandemic in 2020 exacerbated this trend. These dual factors contributed to a significant downturn in private sector activities, prompting increased state intervention.

Consequently, there was a decline in regular tax revenues, coupled with rising budgetary obligations, particularly in healthcare expenditure.

Revenue composition: regular taxation vs. hydrocarbon revenues

To evaluate the reliance of public spending on oil revenues, an examination of the composition of general revenues supporting expenditure is essential. Alongside non-tax and quasi-tax revenues, substantial contributions originate from regular tax and hydrocarbon revenues. Our analysis of Algeria's revenue sources reveals a gradual increase in regular taxation's contribution to total revenues, rising from around 31% in 2000 to approximately 73% in 2020. Meanwhile, hydrocarbon taxation decreased from over 67% in 2000 to 26% in 2020. This shift illustrates Algeria's efforts to diversify revenue sources through enhanced tax policies and support for private sector growth, although hydrocarbon revenues remain significant.

Regular tax revenues encompass all taxes and duties imposed by the state, while hydrocarbon tax revenues specifically pertain to taxes levied on the hydrocarbon sector, predominantly oil and gas. Table 2 delineates the contribution ratios of both regular taxation and hydrocarbon taxation to total revenues.

This dependence led to revenue instability for the state, prompting Algeria to undertake measures to mitigate this reliance by enhancing the efficacy of regular taxation. These efforts materialized through various mechanisms, notably the augmentation of direct and indirect tax rates, alongside initiatives to stimulate private sector engagement. Such endeavors aimed to alleviate fiscal burdens through increased employment opportunities, heightened tax contributions, and the promotion of domestic industries to manufacture goods locally, thereby reducing reliance on imports.

Table 2. Ratios of regular taxation and hydrocarbon revenues to the total earnings

Years	Contribution % of Regular Taxation	Contribution % of Hydrocarbon Taxation
2000	31.06%	67.55%
2002	30.62%	62.24%
2004	36.13%	58.96%
2006	39.13%	54.34%
2008	33.25%	62.03%
2010	42.21%	51.60%
2012	50.17%	43.34%
2014	53.24%	40.17%
2016	49.53%	33.57%
2018	42.44%	38.34%
2019	43.07%	38.15%
2020	73.08%	26.89%
2022	54.36%	31.95%
2023*	59.00%	41.00%

*prognosis

Source: Abdelhamid (2023), APS (2023)

These measures facilitated a sustained increase in the proceeds from regular taxation, juxtaposed with a decline in hydrocarbon taxation with the former, constituting approximately 73% of total taxation compared to the latter's 26% share in 2020.

Impact of oil prices on public spending

Fluctuations in oil prices directly impact public spending due to Algeria's reliance on hydrocarbon revenues. Our analysis confirms that oil price changes correlate with shifts in public spending, though expenditure levels occasionally remain high even when oil prices decline, influenced by other factors such as public consumption needs and declining petroleum production volumes. Table 3 illustrates the progression of public spending as a percentage of GDP alongside the average price of oil in global markets, referencing the Sahara Blend crude mix, which serves as the benchmark for pricing Algerian oil.

Table 3. Evolution of public spending and oil prices

Years	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
DEP *	78.71	85.32	90.13	85.62	85.59	76.86	73.10	77.80	80.73	100.58	92.97	89.89
PRICE	28.77	24.74	24.91	28.73	38.35	54.64	66.05	74.66	98.96	62.35	80.35	112.92
Years	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	
DEP *	91.61	97.20	101.51	113.35	114.18	110.05	106.34	106.38	110.39	99.72	88.73	
PRICE	111.49	109.38	99.68	52.79	44.28	54.12	71.44	64.49	42.12	70.89	104.24	

* **DEP:** Volume of Public Spending (%)

PRICE: Average Price of Oil per Barrel (USD)

Source: World Bank (2024), OIAPEC (2024)

Alterations in oil prices consistently correspond with shifts in the volume of public spending, whether increasing or decreasing, as evidenced in the table above.

We note that an increase in oil prices has often accompanied the overall increase in public expenditure. Conversely, during periods of declining oil prices, there was no corresponding decrease in expenditure, as evidenced notably from 2016 to 2019. On the other hand, we observe instances where despite an increase in oil prices, there was a decline in expenditure. This discrepancy may be influenced by different factors such as an increase in public consumption unrelated to oil prices. Additionally, petroleum production volumes have significantly decreased, resulting in a decline in financial resources derived from this source, consequently leading to a reduction in expenditure.

Econometric analysis of public spending and oil price relationship

The evolution of oil prices during the study period from 2000 to 2022 was monitored using data obtained from the Organization of Arab Petroleum Exporting Countries (OAPEC). Data concerning the volume of public spending were sourced from the World Bank's database. In this section, we define the variable for state public finances as the total public spending as a percentage of GDP, denoted by DEP. Meanwhile, exports in the hydrocarbons sector are represented by the OPEC reference price, denoted by PRICE.

Study of time series stationarity

The stationarity of the variables under examination was assessed through the application of the Phillips-Perron (PP) unit root test. The results obtained from this analysis are presented in Table 4.

Table 4. Variables Stationarity in level

Variables	Model with Intercept and Trend	Model with Intercept	Model without Intercept and Trend
DEP	0.7955	0.4112	0.6946
PRICE	0.6202	0.4345	0.7181
Critical Values at 5%	-3.6328	-3.0048	-1.9572

Prob: At a 5% significance level

Source: Created by the authors using Eviews 13

The calculated t-statistics for both variables across all three models exceeded the critical t-values at the 5% level ($t\text{-tab } 5\% < t\text{-statistic}$). Furthermore, the probability values for the t-statistics surpassed the 5% significance level ($\text{Prob} > 0.05$). Consequently, the variables were deemed unstable at the level, necessitating the repetition of the test using first differences (see Table 5).

Table 5. Variables stationarity in 1st difference

Variables	Model with Intercept and Trend	Model with Intercept	Model without Intercept and Trend
DEP	0.0556	0.0160	0.0008
PRICE	0.0756	0.0156	0.0011
Critical Values at 5%	-3.6449	-3.0123	-1.9580

Prob: At a 5% significance level

Source: Created by the authors using Eviews 13

It was observed that in the third model, which incorporated both an intercept and a trend, the t-statistics for both variables fell below the critical t-values at the 5% level ($t\text{-tab } 5\%$

< t-statistic). Additionally, the probability values for these t-statistics exceeded the 5% significance level (Prob > 0.05). As a result, the variables were considered unstable at first differences, prompting a subsequent examination using second differences (see Table 6).

Table 6. Variables Stationarity in 2nd difference

Variables	Model with Intercept and Trend	Model with Intercept	Model without Intercept and Trend
DEP	Prob: 0.0000	Prob: 0.0000	Prob: 0.0000
PRICE	Prob: 0.0000	Prob: 0.0000	Prob: 0.0000
Critical Values at 5%	-3.6584	-3.0206	-1.9590

Prob: At a 5% significance level

Source: Created by the authors using Eviews 13

It was noted that the calculated t-statistics for both variables in all three models exceeded the critical t-values at the 5% level ($t_{\text{tab}5\%} > t\text{-statistic}$), and the probability values for these t-statistics were below the 5% significance level (Prob < 0.05). Consequently, the variables were considered stable at second differences.

Determining the appropriate lag length for VAR model estimation

The suitable lag length for VAR model estimation was determined through an assessment of various criteria. The endogenous variables considered were DEP and PRICE, while the exogenous variable C was also incorporated into the analysis. The dataset encompassed observations spanning from 2000 to 2022.

Upon examination, it is evident that for a lag length of zero, the log-likelihood (LogL) was -161.5933, with subsequent increases observed for lag lengths of one through four. Notably, the likelihood ratio (LR), final prediction error (FPE), Akaike information criterion (AIC), Schwarz criterion (SC), and Hannan-Quinn criterion (HQ) were all indicative of the optimal lag being at one period (Table 7).

Table 7. Lag order selection

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-161.5933	NA	103237.9	17.22035	17.31977	17.23718
1	-130.2808	52.73696*	5854.221*	14.34534*	14.64359*	14.39582*
2	-129.6781	0.888119	8540.431	14.70296	15.20003	14.78708
3	-127.8873	2.262123	11298.70	14.93550	15.63140	15.05328
4	-126.1789	1.798286	15763.83	15.17673	16.07146	15.32815

Source: Created by the authors Eviews 13

Consequently, it can be concluded that the appropriate lag length for VAR model estimation is one period, denoted as $P=1$. The relationship between the variables in the short term will be examined through the estimation of the VAR model.

Results of estimating the VAR(1) model

At this juncture, the VAR(1) model is estimated, yielding the subsequent results (Table 8):

Table 8. Estimating the VAR(1) model

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.798296	0.110254	7.240522	0.0000
C(2)	0.114842	0.049282	2.330319	0.0252
C(3)	12.00806	10.88629	1.103044	0.2769
C(4)	-0.031079	0.345937	-0.089839	0.9289
C(5)	0.741338	0.154628	4.794320	0.0000
C(6)	23.00169	34.15721	0.673407	0.5048
DEP = C(1)*DEP(-1) + C(2)*PRICE(-1) + C(3)		PRICE = C(4)*DEP(-1) + C(5)*PRICE(-1) + C(6)		
R-squared=0.754229		R-squared=0.547471		

Source: Created by the authors using Eviews 13

The table represents the statistical tests for estimating the equation of the dependent variable DEP as a function of the lagged oil prices (PRICE (-1)) and the lagged dependent variable itself (DEP (-1)) as independent variables.

The explanatory power of the equation is substantial, reaching approximately $R^2=75\%$.

From the estimation results, it is observed that the impact of oil prices on public spending is delineated by the estimated equation:

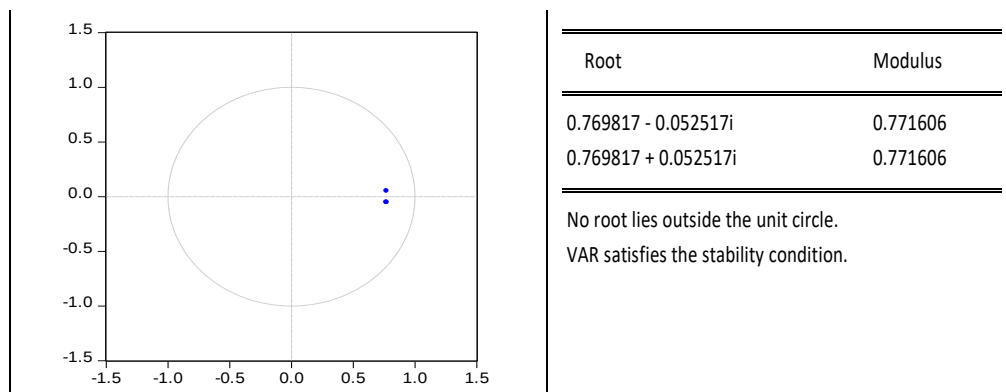
$$DEP_t = 0.798296 * DEP(-1) + 0.114842 * PRICE(-1) + 12.00806$$

The coefficient value of the preceding period's oil prices (0.11) indicates a positive influence on the current period's government spending, with statistical significance established by a probability value (Prob. = 0.02) lower than the 5% level.

Stability of the estimated VAR(1) model

To ascertain the structural stability of the estimated model, an inspection of the unit circle, particularly the inverse roots of the characteristic AR polynomial, was conducted, yielding the following outcomes:

Roots of Characteristic Polynomial: The performed analysis did not identify root lying outside the unit circle, thereby satisfying the stability condition (Figure 1).

**Figure 1: Inverse Roots test**

Source: Created by the authors using Eviews 13

All points representing the inverse roots fell within the unit circle, confirming the stability of the estimated VAR(1) model, supported by the modulus of the inverse roots being less than one.

Diagnostics of the estimated model residuals

Test for autocorrelation of residuals

In the diagnostics of the estimated model residuals, we conducted the Autocorrelation LM Test to assess serial correlation. Table 9 reveals the obtained results:

Table 9. Residual correlation LM test

a/ Null hypothesis: No serial correlation at lag h.						b/ Null hypothesis: No serial correlation at lags 1 to h.						
Lag	Df	Prob.	Rao F-stat	Df	Prob.	Lag	LRE* stat	Df	Prob.	Rao F-stat	Df	Prob.
1	4	0.8646	0.316617	(4, 32.0)	0.8647	1	1.280864	4	0.8646	0.316617	(4, 32.0)	0.8647
2	4	0.6169	0.670601	(4, 32.0)	0.6172	2	3.137521	8	0.9254	0.372783	(8, 28.0)	0.9262

Source: Created by the authors using Eviews 13

It is noteworthy that all residuals exhibit no correlation with each other, as evidenced by the fact that all associated p-values exceed the 5% significance level. Consequently, the null hypothesis of no serial correlation is accepted, indicating that the residuals demonstrate no correlation among themselves.

Residual heteroskedasticity tests

Further assessment was carried out to ascertain the stability of error homogeneity. The White Heteroskedasticity Test (No Cross Terms) was employed, yielding the subsequent outcomes (Table 10):

Table 10. Heteroskedasticity test (Join test)

Chi-sq	Df	Prob.
12.68294	12	0.3925

Source: Created by the authors using Eviews 13

The obtained probability value for the chi-square statistic is 0.3925, which surpasses the critical value of 5%. Consequently, the hypothesis affirming the stability of errors' homogeneity is upheld.

Normal Distribution of Residuals

The test conducted to assess the normal distribution of residuals utilized the Jarque-Bera test. The results obtained are shown in Table 11.

Table 11. Normal Distribution of Residuals

Component	Jarque-Bera	Df	Prob.
1	0.509431	2	0.7751
2	0.287649	2	0.8660
Joint	0.797079	4	0.9388

Source: Created by the authors using Eviews 13

The p-values associated with each estimated equation exceed the critical value of 5%. Furthermore, the joint (overall) p-value for the estimated VAR model also surpasses the 5% critical value. Consequently, we infer that the residuals conform to a normal distribution.

Granger causality test

The obtained p-values (0.38 and 0.35) exceed the conventional 5% significance level, indicating the absence of statistically significant causality in both directions (Table 12).

Table 12. Causality Test

Null Hypothesis:	Prob.
DDPRICE does not Granger Cause DDDEP	0.3836
DDDEP does not Granger Cause DDPRICE	0.3578

Source: Created by the authors using Eviews 13

Discussion

This study contributes to the existing body of research on Algeria's hydrocarbon dependency by analyzing the responsiveness of public spending to oil price fluctuations using a VAR model.

To investigate the relationship between public spending (DEP) and oil prices (PRICE), we conducted a series of econometric tests:

- **Unit Root Testing:** Using the Phillips-Perron test, both variables (DEP and PRICE) were found non-stationary at levels but stationary at second differences, validating their suitability for time series analysis.
- **Lag Length Selection:** Based on multiple criteria (AIC, SC, HQ), a VAR(1) model was chosen as the optimal lag structure for examining short-term dynamics between DEP and PRICE.
- **VAR Model Estimation:** The VAR(1) model results indicate a positive short-term relationship between oil prices and public spending, with a coefficient estimate showing that a 1-unit increase in previous oil prices is associated with a 0.11-unit increase in current public spending. This finding, significant at the 5% level, suggests a degree of fiscal responsiveness to recent oil market conditions.
- **Model Stability and Diagnostics:** Stability checks confirmed the model's robustness, with diagnostic tests (LM test for serial correlation, White's test for homoscedasticity, and the Jarque-Bera test for normal distribution) indicating no significant issues, thereby supporting the validity of the results.
- **Granger Causality Test:** Pairwise causality testing revealed no significant causal direction between oil prices and public spending, highlighting the complexity of Algeria's fiscal dynamics, which depends on multiple variables beyond just oil revenues.

The results highlight a significant yet predominantly short-term influence of global oil prices on Algeria's fiscal policy. This finding adds to prior research (e.g., Bekhaled et al., 2024; Raki and Sedkaoui, 2022), which also observed a strong link between oil prices and fiscal outcomes. However, unlike studies emphasizing a long-term cointegration between oil prices and fiscal policies (Maidi and Benhamida, 2022; Elias Elhannani et al., 2016), our analysis indicates that Algeria's public spending is more immediately reactive, with limited long-term impacts.

The application of the VAR(1) model suggests a positive but statistically insignificant relationship between past oil prices and current public expenditures. This divergence from expectations of a direct correlation between commodity prices and government spending may reflect Algeria's adoption of counter-cyclical spending measures, as per Keynesian principles, to mitigate the effects of oil revenue volatility. These findings support the notion that the country may have employed expenditure-smoothing strategies in response to fluctuating oil revenues.

In the short term, current public spending is significantly influenced by its previous level, with a correlation of around 80%. Additionally, the previous period's oil price affects the current spending by approximately 11%. This means that the current year's spending is largely determined by the previous year's spending, indicating that spending planning is based on past expenditures, while oil prices play a lesser role. This explains our earlier

conclusion regarding the continuous increase in the contribution of regular taxation to total spending compared to oil taxation.

Consistent with Hidouchie and Aouil (2017), the results suggest that despite diversification initiatives, Algeria's economy remains highly sensitive to oil market volatility. While policies aimed at diversification, such as those examined by Kaddouri and Bouaziz (2017), have boosted non-hydrocarbon revenues, they have not significantly reduced public finance dependency on hydrocarbons.

Our findings are also aligned with Bouchaour and Al-Zeaud (2012) analysis of MENA economies, which showed that fiscal policies in oil-exporting nations often respond to short-term revenue volatility rather than being anchored in a long-term fiscal strategy. Nevertheless, our study diverges from Ross (2019), who argued that rentier states like Algeria automatically increase public spending in response to rising oil prices. Instead, our results indicate a degree of fiscal policy stability, likely due to governmental efforts to manage revenue volatility during periods of declining oil prices (e.g. 2015–2020) and amid global disruptions such as the COVID-19 pandemic.

According to the study's hypotheses, we observe that the state's financial resources are consistently moving towards diversification, evidenced by the increase in the contribution of taxes and fees to the budget through higher tax rates and the stimulation of the private sector. The contribution of regular taxation in all its components reached more than 70% in 2020, which is a strong indicator of the trend towards diversifying resources. Notably, however, this diversification may decline, as is expected in 2023 and 2024, due to several factors, such as the decline in private sector activity and the increase in public spending, which serves as a competing factor with a negative impact on the private sector.

By comparing Algeria's fiscal response to oil price fluctuations with those of other oil-exporting nations, such as Oman (Al Jabri et al., 2022) and Iran (Farzanegan, 2009), this study underscores the unique path Algeria has taken. While Oman and Iran have introduced austerity measures and fiscal reforms to mitigate oil dependency, Algeria has maintained sustained public spending, adhering to Keynesian economics, while gradually advancing diversification efforts.

The analysis confirms Algeria's substantial fiscal reliance on hydrocarbon revenues, though recent efforts to increase regular taxation have reduced this dependency marginally. The results illustrate a short-term sensitivity of public spending to oil prices. This finding highlights the need for continued diversification efforts to reduce fiscal vulnerability to oil price volatility. Algeria's heavy reliance on public spending as a driver of economic activity, combined with a fragile private sector and declining foreign investment, makes the economy particularly vulnerable to external shocks. This vulnerability was evident during the 2009 global financial crisis, when public spending surged to counter economic downturns. Such responses reinforce the continued application of Keynesian principles, but they also expose the risks associated with prolonged hydrocarbon dependency.

In summary, this study provides a deeper understanding of Algeria's fiscal policy dynamics in the context of an oil-dependent economy. The findings highlight the limited

effectiveness of diversification policies in reducing the country's reliance on hydrocarbon revenues. These insights are crucial for policymakers, particularly in similarly oil-dependent economies, as they work to balance fiscal stability with diversification efforts. For Algeria, future fiscal resilience will depend on further structural reforms aimed at strengthening the private sector, improving the business environment, and broadening the tax base to ensure sustainable economic growth.

Conclusion

This research provides a comprehensive analysis of Algeria's fiscal dynamics, focusing on the correlation between public spending and oil price volatility and examining the implications of hydrocarbon dependency on fiscal stability and economic diversification. By analyzing data over two decades, this study enhances the understanding of the fiscal responsiveness in an oil-dependent economy like Algeria and underscores the challenges in achieving macroeconomic stability.

Addressing the first research question, the findings reveal a significant, short-term correlation between public spending and oil prices, indicating that Algeria's fiscal policy demonstrates responsiveness to oil market shifts. The VAR(1) model results confirm that Algeria's public spending aligns with short-term oil price fluctuations, reflecting the economy's ongoing sensitivity to hydrocarbon revenue despite diversification efforts. This short-term dependency highlights the difficulty in maintaining budgetary balance and macroeconomic stability under volatile oil market conditions.

In response to the second research question, the study reveals that hydrocarbon dependency has considerable implications for fiscal stability and economic diversification. While there is a growing contribution of regular taxation to state finances, hydrocarbon revenues remain dominant, reinforcing the reliance of fiscal policy on oil market dynamics. This dependency underscores the need for sustained diversification efforts to reduce fiscal vulnerability. The findings indicate that while public spending is impacted by oil prices, other economic factors and historical spending patterns also play critical roles, suggesting a complex fiscal landscape that requires broader structural reforms.

The econometric analysis, marked by the stability of the VAR model and robustness of residual diagnostics, strengthens the validity of these insights, they indicate that a broader spectrum of economic variables influences Algeria's fiscal stability.

In conclusion, the relationship between oil revenues and public spending in Algeria is impactful yet non-deterministic. This study encourages policymakers to continue cultivating a diversified economic structure to support fiscal sustainability and resilience against oil market volatility. Future research should expand the scope to integrate additional socio-economic variables, further advancing insights into economic resilience and sustainable fiscal policies for oil-dependent economies.

References

- Abdelhamid, A. (2023). "The Impact of Tax Pressure on Economic Growth in Algeria During the Period 1992-2019." Unpublished Doctoral Thesis, Akli Mohand Oulhadj University, Bouira, Algeria. [Online]. Available at: <http://dspace.univ-bouira.dz:8080/jspui/handle/123456789/15413> (last visited February, 2024).
- APS (2023). "Budget Settlement Bill: 2020 Budget Implemented at 99.56 Percent." Algerian Press Service, February 23, 2023. [Online]. Available at: <https://www.aps.dz/ar/economie/139947-2020-56-99> (last visited February 2024).
- Aissaoui, A. (2001). *Algeria: The Political Economy of Oil and Gas*. New York and Oxford, UK: Oxford University Press.
- Al Jabri, S., Raghavan, M. and Vespignani, I. (2022). "Oil prices and fiscal policy in an oil-exporter country: Empirical evidence from Oman." In: *Energy Economics*, Vol. 111, 106103. DOI: <https://doi.org/10.1016/j.eneco.2022.106103>
- Amroun, W. (2022). "The Impact of Oil Price Fluctuations on Government Spending in Algeria - A Quantitative Study 2000-2020." Unpublished Doctoral Thesis, University of "08 May 1945", Guelma, Algeria.
- Bekhaled, A., Mahdjoub, M.L. and Saddik, M. (2024). "The impact of oil prices fluctuations on public expenditures in Algeria during 1989-2019." In: *Management & Economics Research Journal*, Vol. 6, Issue 1, 349-369. [Online]. Available at: <https://www.asjp.cerist.dz/en/article/242278> (last visited March, 2024).
- Bouchaour, C. and Al-Zeaud, H. (2012). "Oil price distortion and their impact on Algerian macroeconomic." In: *International Journal of Business and Management*, Vol. 7, Issue 18. DOI: <https://doi.org/10.5539/ijbm.v7n18p99>
- Camporeale, C., Jorizzo, M. and Del Ciello, R. (2021). "Beyond the Hydrocarbon Economy: The Case of Algeria." In: J. Nyagnon and J. Byrne (eds.) *Sustainable Energy Investment – Technical, Market and Policy Innovations to Address Risk*. DOI: 10.5772/intechopen.91033
- Dillman, B. (2002). "Algeria: The political economy of oil and gas - Bookreview." In: *Middle East Journal*, Vol. 56, Issue 3, pp. 332-333.
- El Anshasy, A.A. and Bradley, M.D. (2012). "Oil prices and the fiscal policy response in oil-exporting countries." In: *Journal of Policy Modeling*, Vol. 34, Issue 5, pp. 605–620. DOI: <https://doi.org/10.1016/j.jpolmod.2011.08.021>
- Elias Elhannani, F., Boussalem, A.B. and Benbouziane, M. (2016). "Financial development and the oil curse: Evidence from Algeria." In: *Topics in Middle Eastern and North African Economies*, Vol. 18, Issue 1, pp. 112-125. [Online]. Available at: <http://meeasites.luc.edu/volume18/pdfs/5%20-%20Revised%20Financial%20Dev%203-15-16.pdf> (last visited March, 2024).
- Farzanegan, M.R. and Markwardt, G. (2009). "The impact of oil price shocks on the Iranian economy." In: *Energy Economics*, Vol. 31, Issue 1, pp. 134-151. DOI: <https://doi.org/10.1016/j.eneco.2008.09.003>

- Hidouchie, A. and Aouil, M. (2017). "The impact of oil resources on the macroeconomic variables of the Algerian economy." In: *Milev Journal of Research and Studies*, Vol. 3, Issue 1, pp. 321–343. DOI: <https://doi.org/10.58205/mjrs.v3i1.974>
- Kaddouri, A. and Bouaziz, N. (2017). "The guarantee fund FGAR as a public mechanism to promote entrepreneurship beyond the hydrocarbon sector." In: *Journal of Finance and Corporate Governance*, Vol. 1, Issue 1, pp. 16-30. DOI: <http://dx.doi.org/10.54960/jfcg.v1i1.2>
- Kpodar, K. and Liu, B. (2021). "The distributional implications of the impact of fuel price increases on inflation." In: *Energy Economics*, Vol. 108. DOI: <https://doi.org/10.1016/j.eneco.2022.105909>
- Louglaiti, L. and Dardouri, L. (2019). "The impact of changes in oil prices on monetary and trade policy in Algeria (2000-2017)." In: *Dirassat Journal Economic Issue*, Vol. 10, Issue 2, pp. 303-316. DOI: <http://dx.doi.org/10.34118/djei.v10i2.213>
- Maidi, M.E. and Benhamida, M. (2022). "The impact of oil price fluctuation on public expenditures in Algeria – Econometric study." In: *Journal of Economic Integration*, Vol. 10, Issue 4, pp. 263-274. [Online]. Available at: <https://www.asjp.cerist.dz/en/article/215466> (last visited March, 2024).
- Malik, A. (2007). "How Pakistan is coping with the challenge of high oil prices." In: *The Pakistan Development Review*, Vol. 46, Issue 4, pp. 551–575.
- OAPEC (2024). OAPEC database system. [Online]. Available at: <http://oapecdbsys.oapecorg.org:8081/ords/f?p=100:34:::RP> (last visited January, 2024).
- Raki, A. and Sedkaoui, S. (2022). "The impact of oil price fluctuations on Algerian government spending: Empirical study using ARDL self-regression model during 1983–2020." In: *Creativity Review*, Vol. 12, Issue 2, pp. 498-514. [Online]. Available at: <https://www.asjp.cerist.dz/en/article/215466> (last visited March, 2024).
- Ross, M.L. (2019). "What do we know about export diversification in oil-producing countries?" In: *The Extractive Industries and Society*, Vol. 6, Issue 3, pp. 792–806. DOI: <https://doi.org/10.1016/j.exis.2019.06.004>
- World Bank (2024). Gross national expenditure (% of GDP) – Algeria. World Bank national accounts data, and OECD National Accounts data files. [Online]. Available at: <https://data.worldbank.org/indicator/NE.DAB.TOTL.ZS?end=2023&locations=DZ&start=1960&view=chart> (last visited January, 2024).