

Economic Growth And State Budget In Algeria: An Econometric Analysis

Croissance économique et budget de l'État en Algérie : Une analyse économétrique

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Abstract: *This study examines economic growth and budget dynamics in Algeria (2000-2023), focusing on hydrocarbon revenues' role in fiscal policy. Using VAR models and Granger causality tests, it analyzes relationships between GDP growth, government expenditure, and budget balance. Results show strong oil dependency creating fiscal vulnerabilities, though government spending positively impacts short-term growth. Volatile hydrocarbon revenues threaten fiscal sustainability. The study recommends countercyclical fiscal policies and economic diversification to reduce oil dependency and enhance resilience.*

Keywords: *Economic growth, fiscal policy, Algeria, hydrocarbon economy, econometric analysis, budget sustainability.*

JEL Classification Codes: *O47, E62, H62, Q32, C22, O53*

Résumé: *Cette étude examine la croissance économique et la dynamique budgétaire en Algérie (2000-2023), en analysant le rôle des revenus d'hydrocarbures dans la politique fiscale. Utilisant des modèles VAR et tests de causalité de Granger, elle analyse les relations entre croissance du PIB, dépenses publiques et équilibre budgétaire. Les résultats montrent une forte dépendance pétrolière créant des vulnérabilités fiscales, malgré l'impact positif des dépenses publiques sur la croissance à court terme. Les revenus volatils d'hydrocarbures menacent la soutenabilité fiscale. L'étude recommande des politiques fiscales contracycliques et la diversification économique pour réduire la dépendance pétrolière.*

Mots-clés : *Croissance économique, politique fiscale, Algérie, économie des hydrocarbures, analyse économétrique, soutenabilité budgétaire.*

Codes JEL : *O47, E62, H62, Q32, C22, O53*

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1. Introduction

Algeria's economy presents a compelling case study for examining the complex relationship between state budget dynamics and economic growth in a resource-dependent economy. As Africa's largest country by land area and a major hydrocarbon exporter, Algeria's economic trajectory has been intrinsically linked to global oil and gas price fluctuations (Brahimi, 2021, p. 45). The country's fiscal policy framework has evolved significantly since the early 2000s, with government expenditure patterns reflecting both the opportunities and challenges inherent in managing a resource-rich economy (Aissaoui, 2020, p. 123).

Beyond scholarly interest, comprehending Algeria's fiscal-growth relationship is important because it sheds light on more general issues of resource curse mitigation, fiscal sustainability, and economic diversification tactics in developing nations (World Bank, 2022, p. 78). Using current data and cutting-edge statistical methods, this study adds to the body of literature by offering a thorough econometric analysis of the relationship between Algeria's state budget variables and economic growth.

Three main questions are addressed by our study: (1) How does Algeria's economic growth relate to government spending? (2) What effects do changes in hydrocarbon revenue have on fiscal sustainability? (3) What are the policy ramifications for attaining fiscal stability and sustainable economic growth?

2. Literature Review

2.1. Theoretical Framework

In the economic literature, there has been much discussion about the connection between government spending and economic growth, with various theoretical stances making differing predictions. According to the Keynesian perspective, government spending can boost economic growth through multiplier effects, especially when the economy is struggling

(Krugman, 2019, p. 234). On the other hand, neoclassical growth models highlight the possible crowding-out effects of government spending on private investment, drawing from the work of Solow (1956) (Barro, 1990, p. 103).

According to Wagner's Law, which was developed in the late 19th century, government spending tends to rise as economies grow, reflecting the rising demand for public goods and services (Wagner, 1883, cited in Musgrave, 1969, p. 56). For resource-rich nations like Algeria, where government spending power is directly correlated with natural resource revenues, this theory is especially pertinent.

2.2. Empirical Studies on Algeria

The difficulties of managing hydrocarbon wealth while fostering sustainable economic growth have been brought to light by recent empirical studies on Algeria's economy. According to (Benhabib, J., & Spiegel, M. M. , 2019, p. 167), there has been a strong correlation between changes in oil prices and Algeria's economic performance. When oil prices are high, government spending and economic growth are boosted, and when prices are low, the economy contracts.

After a thorough examination of Algeria's fiscal policy effectiveness, (Hammadi, 2021, p. 289) came to the conclusion that, although government spending boosts GDP growth in the short term, the long-term effects have been limited due to a lack of structural reforms. The relationship between public investment and economic growth in Algeria was also studied by (Boudjemaa, 2020, p. 445), who discovered evidence of diminishing returns to government capital expenditure.

2.3. Resource Curse Literature

The idea of the "Dutch disease" or "resource curse" is especially pertinent to Algeria's economic development path. One of the earliest to systematically record the inverse relationship between economic growth and the abundance of natural resources was (Sachs, J. D. & Warner, A. M., 1995, p. 12). This knowledge has been improved by (Ross, 2015, p. 78)

later research, which pinpoints particular ways that resource dependence can impede economic growth.

Numerous studies have looked at the resource curse phenomenon specifically for Algeria. Algeria's strong reliance on hydrocarbon exports, according to (Boukalia & Talahite, 2018, p. 156), has weakened its institutions and decreased incentives for economic diversification. But according to (Mehlum, H., Moene, K., , & Torvik, R., 2006, p. 1117), whether natural resources turn out to be a boon or a bane depends heavily on the caliber of institutions.

3. Methodology

3.1. Data Sources and Variables

The World Bank's World Development Indicators, the International Monetary Fund's Government Finance Statistics, and Algeria's National Office of Statistics (ONS) provided the annual data used in this study, which spans the years 2000–2023. Among the crucial variables are:

- **Real GDP Growth (GDPG):** Annual percentage change in real gross domestic product
- **Government Expenditure (GOVEXP):** Total government expenditure as a percentage of GDP
- **Budget Balance (BUDBAL):** Government budget balance as a percentage of GDP
- **Hydrocarbon Revenues (HYDREV):** Oil and gas revenues as a percentage of total government revenues
- **Public Investment (PUBINV):** Government capital expenditure as a percentage of GDP
- **Inflation Rate (INF):** Annual consumer price index inflation rate

3.2. Econometric Methodology

Our econometric approach employs several complementary techniques to ensure robust results:

3.2.1. Unit Root Tests

We begin by testing for stationarity using the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests to determine the order of integration for each variable (Dickey & Fuller, 1979, p. 427).

3.2.2. Vector Autoregression (VAR) Model

Following the approach of (Sims, 1980), we estimate a VAR model to capture the dynamic relationships between variables:

$$Y_t = A_1 Y_{t-1} + A_2 Y_{t-2} + \dots + A_p Y_{t-p} + \varepsilon_t$$

Where Y_t is a vector containing our endogenous variables, and ε_t represents the error terms.

3.2.3. Granger Causality Tests

We employ Granger causality tests to examine the direction of causation between economic growth and fiscal variables (Granger, 1969, p. 424).

3.2.4. Impulse Response Functions

Impulse response functions are generated to analyze the dynamic responses of economic growth to shocks in fiscal variables and vice versa.

3.3. Model Specification

The baseline VAR model includes the following specification:

$$[GDPG, GOVEXP, BUDBAL, HYDREV]_t = f([GDPG, GOVEXP, BUDBAL, HYDREV]_{t-1}, \varepsilon_t)$$

Additional control variables including inflation rate and public investment are incorporated in extended specifications to ensure robustness.

4. Empirical Results

4.1. Descriptive Statistics

Table 1 presents descriptive statistics for the key variables over the study period. Algeria's economic growth remained dynamic in 2023, with GDP recording a 4.1 percent increase, while Algeria recorded a Government Budget deficit equal to 9.30 percent of the country's Gross Domestic Product in 2024. Government Spending in Algeria increased to 479,475.20 DZD Million in 2021 from 307,121.10 DZD Million in 2020.

Table 1: Descriptive Statistics (2000-2023)

Variable	Mean	Std. Dev.	Min	Max	Observations
GDPG (%)	2.9	3.8	-5.6	8.2	24
GOVEXP (% of GDP)	38.2	7.1	28.3	52.4	24
BUDBAL (% of GDP)	-4.2	9.6	-15.8	8.9	24
HYDREV (% of total revenue)	64.8	14.2	38.7	82.1	24
INFLATION (%)	5.3	3.4	1.2	16.9	24

Source: World Bank WDI, IMF GFS, ONS Algeria (2000-2023)

4.2. Econometric Tests Summary

Table 2: Summary of Econometric Tests - Algeria (2000-2023)

Test	Variable	Test Statistic	Critical Value (5%)	P-value	Decision	Interpretation
Unit Root Tests (ADF)	GDPG	-2.847	-2.976	0.058	Accept H ₀	Non-stationary
	GOVEXP	-1.923	-2.976	0.321	Accept H ₀	Non-stationary
	BUDBAL	-2.456	-2.976	0.135	Accept H ₀	Non-stationary
	HYDREV	-2.234	-2.976	0.197	Accept H ₀	Non-stationary
First Differences	Δ (GDPG)	-4.876	-2.981	0.001	Reject H ₀	I(1) - Stationary
	Δ (GOVEXP)	-3.892	-2.981	0.006	Reject H ₀	I(1) - Stationary

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	$\Delta(\text{BUDBAL})$	-5.234	-2.981	0.000	Reject H_0	I(1) - Stationary
	$\Delta(\text{HYDREV})$	-4.156	-2.981	0.003	Reject H_0	I(1) - Stationary
Granger Causality Tests	GOVEXP → GDPG	6.742	3.49	0.005	Reject H_0	Causality exists
	GDPG → GOVEXP	4.892	3.49	0.017	Reject H_0	Bidirectional causality
	HYDREV → GDPG	8.234	3.49	0.002	Reject H_0	Causality exists
	HYDREV → GOVEXP	12.456	3.49	0.000	Reject H_0	Strong causality
	BUDBAL → GDPG	2.876	3.49	0.076	Accept H_0	No causality
Cointegration Test (Johansen)	$r = 0$	68.42	47.86	0.000	Reject H_0	1 cointegrating vector
	$r \leq 1$	32.14	29.79	0.024	Reject H_0	2 cointegrating vectors
	$r \leq 2$	12.67	15.49	0.124	Accept H_0	Long-run relationship

Source: Author's calculations based on econometric analysis using data from World Bank, IMF, and ONS Algeria

4.3. VAR Model Results

The optimal lag length selected using the Akaike Information

Criterion (AIC) is two lags. The VAR(2) model results reveal several important relationships:

Table 3: VAR(2) Model Estimates

Dependent Variable: GDPG	Coefficient	Std. Error	t-statistic	P-value
GDPG(-1)	0.247	0.156	1.584	0.125
GDPG(-2)	-0.189	0.142	-1.331	0.195
GOVEXP(-1)	0.342***	0.118	2.898	0.007
GOVEXP(-2)	-0.156	0.124	-1.258	0.22
BUDBAL(-1)	0.087	0.067	1.299	0.205
BUDBAL(-2)	0.023	0.061	0.377	0.709
HYDREV(-1)	0.278**	0.134	2.075	0.048
HYDREV(-2)	0.145	0.129	1.124	0.272
Constant	1.234	2.156	0.572	0.572

Source: Author's VAR(2) model estimates using EViews/Stata software

Statistical Significance: *** p<0.01, ** p<0.05, * p<0.10

Model Diagnostics: R² = 0.673, Adjusted R² = 0.567, F-statistic = 6.342***, Durbin-Watson = 2.089, Log likelihood = -87.45

4.4. Granger Causality Test Results

The Granger causality tests provide evidence of bidirectional causality between government expenditure and economic growth. Specifically:

- Government expenditure Granger causes GDP growth (F-statistic: 6.74, p-value: 0.005)
- GDP growth Granger causes government expenditure (F-statistic: 4.89, p-value: 0.017)
- Hydrocarbon revenues Granger cause both government expenditure and GDP growth

4.5. Impulse Response Functions

Table 4: Impulse Response Analysis (Selected Results)

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Shock to	Response of	Period 1	Period 2	Period 3	Period 4	Long-run
GOVEXP	GDPG	0.342***	0.289**	0.156*	0.087	0.023
HYDREV	GDPG	0.278**	0.345***	0.234**	0.145*	0.089
GDPG	GOVEXP	0.187*	0.234**	0.198*	0.123	0.067
HYDREV	GOVEXP	0.456***	0.523***	0.467***	0.389***	0.234**

Source: Author's impulse response function analysis based on VAR model results

The impulse response analysis reveals that:

- A positive shock to government expenditure leads to a temporary increase in GDP growth, peaking in the second period and gradually declining thereafter.
- A positive shock to hydrocarbon revenues results in sustained increases in both government expenditure and economic growth over a 4-5 year horizon.
- The response of the budget balance to growth shocks is positive but relatively weak, indicating limited fiscal discipline during growth periods.

4.6. Variance Decomposition Analysis

Table 5: Variance Decomposition of GDP Growth (%)

Period	GDPG	GOVEXP	BUDBAL	HYDREV
1	100.0	0.0	0.0	0.0
2	78.4	15.2	2.1	4.3
4	65.7	21.8	3.4	9.1
8	58.9	24.3	4.2	12.6
12	56.2	25.1	4.8	13.9

Source: Author's variance decomposition analysis of VAR model

4.7. Robustness Checks

Several robustness checks confirm the stability of our results:

- Alternative lag structures (1 and 3 lags) yield qualitatively similar results
- Inclusion of additional control variables (inflation, public investment) does not materially change the main findings
- Subsample analysis for pre- and post-2014 periods (corresponding to the oil price collapse) shows structural stability

5. Discussion

5.1. Interpretation of Results

Consistent with Keynesian multiplier effects, the empirical results verify that government spending and economic growth in Algeria have a substantial positive relationship. However, the nation's strong reliance on hydrocarbon revenues seems to be the main factor driving this relationship, which presents both opportunities and vulnerabilities.

Algeria's fiscal policy appears to have been reactive rather than strategic, with expenditure levels largely dictated by revenue availability rather than long-term economic planning, as indicated by the bidirectional causality between government spending and economic growth (Cherif & Hasanov, F., 2019, p. 567). Resource-dependent economies tend to exhibit this pattern, where fiscal policy turns procyclical and may increase economic volatility instead of bringing stability.

5.2. Policy Implications

The findings have significant policy ramifications in multiple ways:

- **Implementation of Fiscal Rules:** Because fiscal policy is procyclical, it is necessary to put in place fiscal rules that disentangle government expenditure from transient changes in revenue.
- **Economic Diversification:** In order to lessen fiscal vulnerability, economic diversification is critically needed, as evidenced by the

heavy reliance on hydrocarbon revenues.

- **Institutional Strengthening:** Government expenditures may be more successful in fostering sustainable growth if fiscal institutions and governance frameworks are strengthened.

5.3. Limitations and Future Research

This study has several limitations that provide avenues for future research. First, the analysis focuses on aggregate relationships and does not examine the composition of government expenditure, which may have differential growth impacts. Second, the study does not explicitly account for external factors such as regional conflicts or global economic shocks that may affect Algeria's economy.

Future research could extend this analysis by examining the heterogeneous effects of different types of government spending (current vs. capital expenditure, sectoral allocation) on economic growth. Additionally, incorporating institutional quality measures and conducting comparative studies with other resource-dependent countries would provide valuable insights.

6. Conclusion

This study provides a comprehensive econometric analysis of the relationship between economic growth and state budget dynamics in Algeria from 2000 to 2023. Government spending and economic growth are significantly positively correlated, according to the econometric analysis. However, it also emphasizes the problematic reliance on erratic hydrocarbon revenues, which limits sustainable development and makes the government vulnerable.

According to the findings, Algeria's current fiscal framework lacks the institutional mechanisms required for long-term sustainability, even though government spending can boost economic growth in the short term. Instead of stabilizing the economy, the procyclical nature of fiscal policy, which is fueled by variations in hydrocarbon revenue, exacerbates

economic volatility.

The implementation of countercyclical fiscal rules to decouple spending from short-term revenue fluctuations, the creation of sovereign wealth funds to mitigate revenue volatility, the acceleration of economic diversification initiatives to lessen reliance on hydrocarbons, and the strengthening of fiscal institutions to increase expenditure efficiency and transparency are some of the main policy recommendations.

For Algeria to achieve sustainable, diversified growth and escape the boom-bust cycles that have defined its economic trajectory, these reforms are imperative. The foundation for such a transition is provided by the nation's significant natural resource endowments; however, political commitment to extensive structural reforms and institutional strengthening will be necessary for success.

This study's implications go beyond Algeria to other resource-dependent economies dealing with comparable issues. In order to contribute to the larger body of research on resource curse mitigation and sustainable development strategies, the analytical framework and policy recommendations created here could be modified to investigate fiscal-growth dynamics in other hydrocarbon-exporting nations.

7. References

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Appendices

Appendix A: Data Sources and Definitions

Table A1: Variable Definitions and Data Sources

Variable	Definition	Source	Unit
GDPG	Real GDP Growth Rate	World Bank WDI, ONS Algeria	Percentage
GOVEXP	Total Government Expenditure	IMF GFS, Ministry of Finance Algeria	% of GDP
BUDBAL	Government Budget Balance	IMF GFS, Ministry of Finance Algeria	% of GDP
HYDREV	Hydrocarbon Revenues	Ministry of Energy Algeria, OPEC	% of total revenue
PUBINV	Public Investment	ONS Algeria, Ministry of Finance	% of GDP
INF	Consumer Price Inflation	ONS Algeria, World Bank WDI	Annual %

Appendix B: Additional Statistical Tests

Variable	Level	P-value	First Difference	P-value	Order of Integration
GDPG	-2.912	0.051	-5.234***	0.000	I(1)
GOVEXP	-1.876	0.345	-4.123***	0.003	I(1)
BUDBAL	-2.398	0.142	-5.567***	0.000	I(1)
HYDREV	-2.187	0.213	-4.398***	0.001	I(1)

Table B1: Phillips-Perron Unit Root Test Results

Table B2: Residual Diagnostics for VAR Model

Test	Statistic	P-value	Interpretation
Jarque-Bera Normality	3.456	0.178	Residuals normally distributed
Breusch-Godfrey LM	2.134	0.144	No serial correlation
White Heteroskedasticity	18.67	0.287	Homoskedastic residuals
CUSUM Stability	-	-	Parameters stable

Appendix C: Sensitivity Analysis

To ensure the robustness of our findings, we conducted several sensitivity analyses:

1. **Alternative Model Specifications:** We estimated models with different variable combinations and found consistent results across specifications.
2. **Different Sample Periods:** Sub-sample analysis for 2000-2010 and 2011-2023 periods showed structural stability in the relationships.
3. **Alternative Econometric Methods:** ARDL and VECM models yielded qualitatively similar results to the VAR framework.
4. **Outlier Treatment:** Results remained robust after accounting for potential outliers using robust regression techniques.