Estimating Algeria's Fiscal Reaction Function

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Abstract: This research assesses government debt sustainability in Algeria using fiscal reaction functions over the period 1980–2023, based on annual data. The fiscal reaction function incorporates three explanatory variables: public debt, the output gap, and energy revenues as a share of GDP. The function is estimated using the Autoregressive Distributed Lag (ARDL) bounds testing approach, following unit root testing via the Phillips-Perron (PP) test. Findings reveal that the Algerian government counteracts rising public debt by adjusting its primary balance, though the response magnitude remains limited. Primary surpluses generated are modest relative to debt increases. Algeria's fiscal policy regarding oil and gas revenues demonstrates prudence and sustainability, with energy revenues being effectively allocated toward debt reduction and public investment. The study confirms a significant long-term relationship between primary balance and public debt, indicating fiscal authorities respond to debt accumulation through surplus generation, supporting sustainable debt management practices.

Key words: fiscal sustainability, Fiscal Reaction Function, fiscal policy, primary balance, ARDL model.

Jel Classification Codes : E62, H63, C63.

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Introduction:

Fiscal policy fundamentally aims to ensure the optimal use of resources, promote fair income distribution, and support macroeconomic stability. Over the past three decades, growing scholarly and policy-oriented attention has been directed toward assessing fiscal sustainability as a crucial component of macroeconomic health. When a government fails to generate sufficient future primary surpluses to meet its current debt obligations, thereby violating intertemporal budget constraints, such policies become unsustainable and may precipitate sovereign insolvency (Kia, 2008). Consequently, a fiscal position is deemed sustainable only if the government is expected to meet its debt obligations without resorting to excessively large future adjustments in revenue or expenditure.

Economic literature presents a wide spectrum of methodological approaches aimed at assessing fiscal sustainability. Among these, the fiscal reaction function stands out as a leading analytical tool. Rooted in the intertemporal budget constraint model proposed by (Bohn 2007), this approach evaluates the extent to which primary fiscal balances adjust in response to shifts in public debt levels. At its core, the framework investigates the sensitivity of government revenues and expenditures to rising debt, offering insights into the government's commitment to fiscal discipline. The method has gained considerable academic traction, especially in studies addressing debt sustainability challenges in emerging and developing economies .

Among the studies that have applied the fiscal reaction function framework, Bohn (1998) demonstrated that U.S. fiscal policy responds positively to rising debt, confirming long-term sustainability. De Mello (2008) reached similar conclusions for Brazil, while Burger et al. (2011) found evidence of fiscal sustainability in South Africa, albeit with a modest primary balance response. In the context of oil-dependent economies, Kia (2008) estimated a fiscal reaction function for Iran and Turkey, explicitly incorporating energy revenues, and found that oil income plays a significant role in shaping fiscal sustainability. However, studies specifically addressing Algeria remain scarce, and existing work either relies on shorter time spans or does not account for the structural role of hydrocarbon revenues within the fiscal reaction function framework. This study addresses these gaps by covering the extended period 1980–2023 and explicitly modeling energy revenues as a key determinant of Algeria's primary balance. The central research question is: Does Algeria's fiscal policy respond systematically to rising public debt levels in a manner consistent with long-term fiscal sustainability, and what role do energy revenues play in shaping this response?

This research seeks to conduct an empirical analysis of Algeria's fiscal response to public debt developments by estimating the fiscal reaction function over the period 1980–2023. The central objective is to determine whether the relationship between the primary fiscal balance and the level of public debt is consistent with the theoretical predictions of the intertemporal budget constraint framework. The remainder of this study is structured as follows:

The subsequent section provides a comprehensive analytical review of Algeria's fiscal policy. Section 3 elucidates the theoretical underpinnings and conceptual framework of the fiscal reaction function. Section 4 delineates the methodological approach employed in this investigation and presents the empirical data utilized. Section 5 encompasses a thorough exposition of the empirical findings accompanied by rigorous analytical interpretation. Section 5 presents the policy recommendations derived from the empirical findings. The final section, Section 6, synthesizes the main conclusions and discusses their broader implications.

2. Fiscal situation in Algeria

The Algerian economy exhibits pronounced dependence on its hydrocarbon sector. Throughout the temporal period spanning from 1980 to 2023, hydrocarbon proceeds constituted approximately 96% of export revenues and 60% of aggregate budgetary resources, notwithstanding the sector's relatively modest 30% contribution to gross domestic product. Consequently, petroleum price volatility exerts substantial influence on macroeconomic

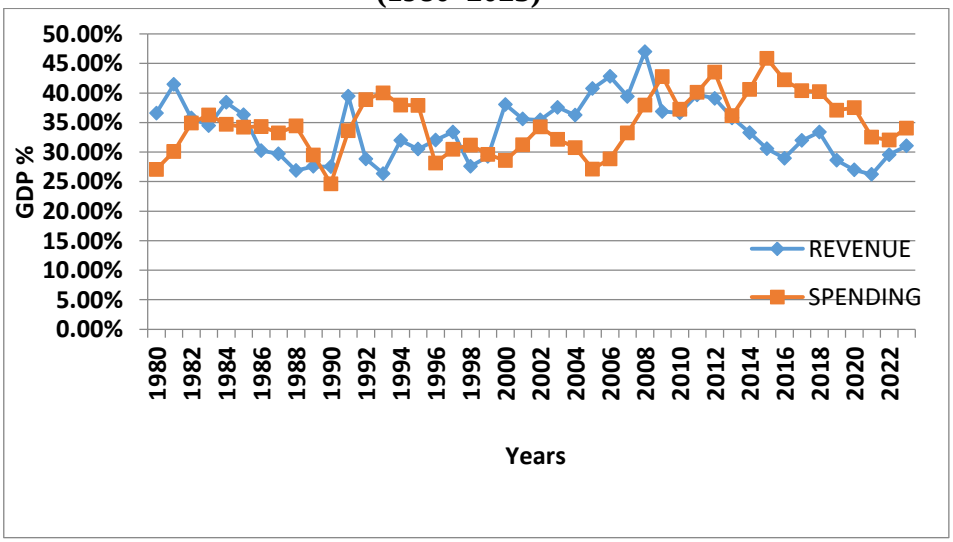
equilibrium parameters, thereby introducing significant complexity into the formulation and implementation of economic policy frameworks.

Public spending is considered one of the financial policies' pillars to achieve economic, social, and political goals. The fiscal policy in Algeria is the most important macroeconomic policy instrument. During periods of rising oil prices, oil revenue is used to finance permanent expenditure increases. This permanent demand on the budget is difficult to reverse during periods of falling oil prices. Total government expenditure increased by 52% between 1990 and 2023 and by 164% between 1980 and 2023, (see Figure 1). Despite the fact that high oil prices allowed Algeria to develop infrastructure, achieve social stability, and make significant progress toward meeting the Millennium Development Goals (IMF 2017), the Algerian government did not change its growth model during the more than 14 years of high oil prices between 2000 and 2014, The Algerian economic structure has maintained profound dependence on hydrocarbon revenues and government expenditure throughout the examined period .

Indeed, the Algerian government has taken measures to deal with the challenges of living with lower oil prices by adjusting its public finance policies. It implemented preliminary austerity measures, reducing state spending by 9% in 2016 and 14% in 2017. Government spending in 2018 also includes some cuts.

The limited fiscal adjustment observed during this period can be partly explained by the structural rigidity of public expenditure. Current spending, particularly wages and subsidies, represents a large and politically sensitive share of total outlays, making downward adjustment difficult even during periods of fiscal stress. Furthermore, the Algerian government's historical reliance on the hydrocarbon stabilization fund as a fiscal buffer, rather than implementing systematic tax-based adjustment measures, has weakened the structural link between debt accumulation and primary balance adjustment. This structural dependence on energy revenues distinguishes Algeria's fiscal dynamics from those of economies with more diversified revenue bases.

Figure 1. Trends in Government Spending and Revenue (% of GDP) in Algeria (1980–2023)



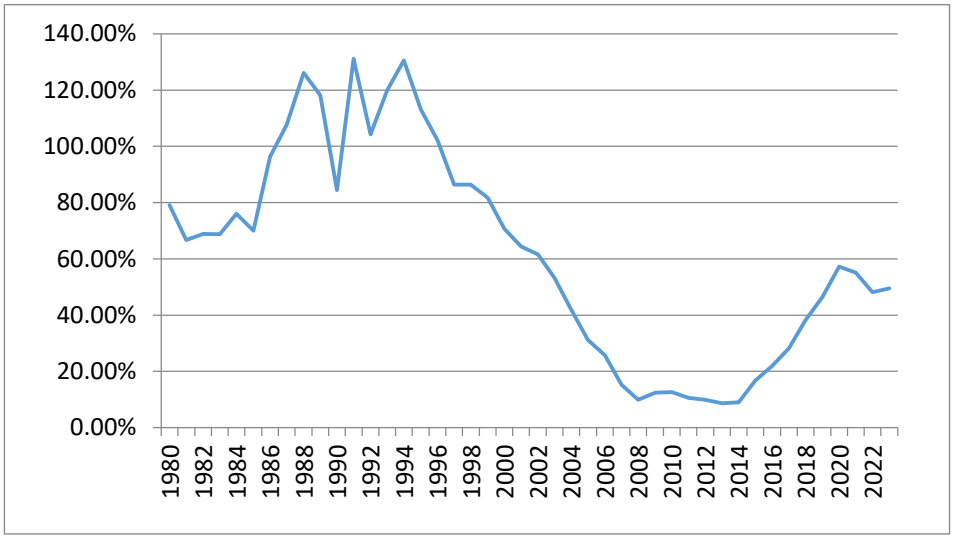
Source: The Ministry of Finance 2025.

During the decade of high oil prices between 2001 and 2014, Algeria paid down most of its external debt and made large fiscal savings. Over the period of 2008–2015, government debt remained relatively low at around 8 percent of GDP, (IMF 2021). Following the sharp decline in oil prices in mid-2014, coupled with the depletion of fiscal buffers -specifically the stabilization fund- and the significant reduction in foreign exchange reserves, public debt witnessed a marked escalation. It rose from 8.8% of GDP at the end of 2015 to 21.0% by the end of 2016, ultimately reaching 50.7% in 2020 (see Figure 2). This upward trajectory in public debt levels primarily

reflects persistent primary fiscal deficits and subdued economic growth, both of which were exacerbated by successive oil price shocks and the adverse economic consequences of the COVID-19 pandemic.

The Algerian authorities have consistently rejected the option of external borrowing, opting instead for domestic financial instruments to meet fiscal needs. In 2016, the government introduced a local currency bond referred to as the National Bond for Economic Growth in an effort to diversify its sources of financing (IMF 2017). Subsequently, in October 2017, the government adopted a new framework encompassing both fiscal and monetary policies, which included direct monetary financing of the fiscal deficit. Under this arrangement, the Bank of Algeria played a central role in financing public expenditures, resulting in approximately 70% of the outstanding government debt at the end of 2020 being held by the central bank (IMF 2021). By the end of 2019, the value of loans extended by the Bank of Algeria to the public treasury had reached approximately 6,556.2 billion Algerian dinars (Chibi, Chekouri, Benbouziane, and Boulila 2022). The dual impact of the COVID-19 pandemic and the sharp decline in oil prices significantly contributed to the widening of the fiscal deficit over the period 2019–2021. Nevertheless, the fiscal outlook improved in 2022, with the budget deficit contracting by approximately 77% within a single year.

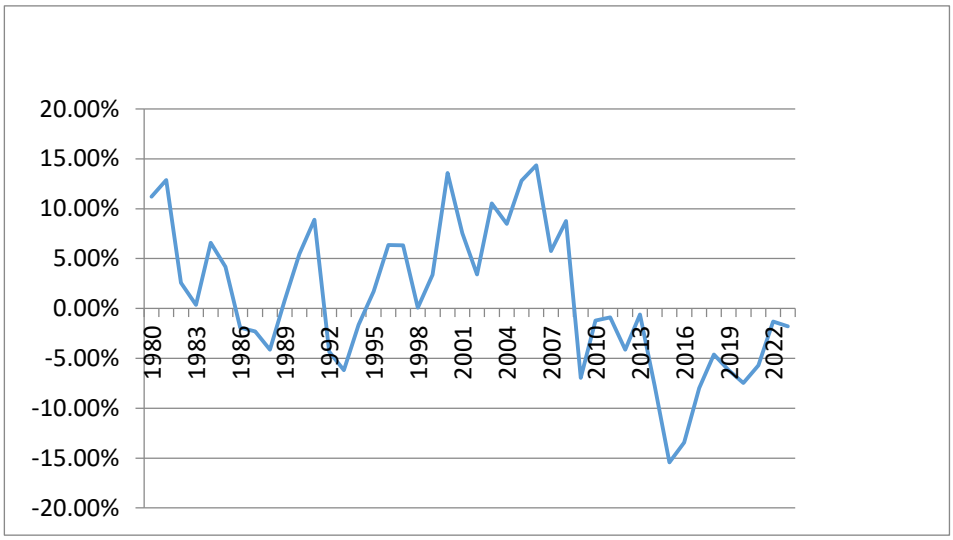
Figure 2. Public debt (% of GDP) in Algeria (1980-2023)



Source: The Ministry of Finance 2025

With a deficit of around 6.78 percent of GDP, Algeria experienced its first primary deficit in 2009, after a decade of surplus, due to a sharp fall in oil and gas revenues, however, and current spending increased by 15 % as a result of supplemental maintenance expenses for infrastructure and employment aid programs (Amal and Siham 2017), the sharp decline in oil revenues beginning in mid-2014 significantly widened Algeria's primary fiscal deficit, which had already been on an upward trajectory—from 4.13% of GDP in 2012 to 15.44% in 2015. However, this trend partially reversed in subsequent years, with the deficit declining to 13.44% in 2016 and further to 7.98% in 2017. This improvement was largely attributed to a reduction in capital expenditures and the receipt of substantial dividends from the Bank of Algeria (see Figure 3). Between 2017 and 2019, the government's adoption of direct monetary financing contributed to a continued reduction in the primary deficit, which reached 6.18% of GDP by 2019. In response to the COVID-19 pandemic and its adverse effects on economic sectors and vulnerable social groups, the primary deficit increased again to 7.74% in 2020. Nevertheless, as oil prices rebounded and the broader economy showed signs of recovery, the primary balance deficit widened to 7.74% of GDP in 2020, before decreasing to 5.7% in 2021 and further to 1.8% in 2023, due to rising oil prices and improved performance of the Algerian economy.

Figure 3. Primary overall balance (% of GDP) in Algeria (1980-2020)



Source: The Ministry of Finance 2025

3. Theoretical background on fiscal reaction function

The existing literature has used two methods. The first approach relies on a set of quantitative sustainability indicators to evaluate fiscal performance, In contrast, the second approach conducts formal sustainability tests grounded in the intertemporal government budget constraint. The approach of checking whether the government satisfies inter temporal budget constraint (Inter temporal Fiscal Constraint) is a popular method (Vural 2018). Studies employing the intertemporal budget constraint framework can generally be categorized into three main methodological approaches. The first category, exemplified by works such as (Hamilton and Flavin 1986), (Wilcox 1989), (Hakkio and Rush 1991), and others, focuses on testing the stationarity of public debt or fiscal deficit series to assess sustainability. The second category, represented by (Quintos 1995), (Martin 2000), and (Payne 1997) employs cointegration techniques to examine the existence of a long-run equilibrium relationship between key fiscal variables, such as government revenue and expenditure. The third approach, adopted by researchers including (Bohn 1998), (Kia 2008), (De Mello 2008), and (Burger, Ian, Jooste, and Cuevas 2011), utilizes a fiscal reaction function framework to evaluate whether government policy responds systematically to rising debt levels, thereby ensuring long-term fiscal sustainability. (Bohn 2007) argues that traditional time series methods-such as unit root and cointegration tests-may not provide sufficient grounds to reject the validity of the intertemporal budget constraint. He emphasizes that discrepancies between fiscal data and the transversality condition cannot be conclusively determined based solely on the failure of these conventional statistical techniques. To address this limitation, Bohn advocates for an alternative approach using the fiscal reaction function, framed within an error-correction model. This approach underscores the significance of maintaining long-term fiscal discipline by analyzing the extent to which fiscal policy systematically responds to rising levels of public debt over time.

The fiscal reaction approach is generally conceptualized as a policy rule aimed at guiding the achievement of fiscal objectives across various time horizons, while enabling governments to anticipate and adapt to fiscal developments (Nguyen 2013). Within this framework, two main methodological approaches have emerged for assessing fiscal sustainability. The first approach involves the use of iterative processes to derive fiscal reaction functions, as demonstrated in studies (Penalver and Thwaites 2006), (Budina 2008). The second approach relies on econometric estimation techniques to empirically assess the responsiveness of fiscal policy to debt dynamics. This method has been widely employed in the literature, including by (Bohn 1998), (Kia 2008), (De Mello 2008) (Burger, Ian, Jooste and Cuevas 2011**).**

3.1 Model specification

Fiscal reaction functions are fundamentally based on the notion of the government's intertemporal budget constraint, a framework that does not adhere to a single, universally accepted specification. The formulation of these models varies considerably, influenced by the theoretical orientations and empirical strategies employed across the literature. In the context of this research, the fiscal reaction function is constructed in accordance with the methodologies advanced by (Kia 2008) and Burger, (Burger, Ian, Jooste and Cuevas 2011). The nominal representation of the government's intertemporal budget constraint is adopted as presented in the work of (Osmani and oukil 2021):

$$B_{t+1}= (1+r)\, B_t+G_t-T_t= (1+r)\, B_t-S_t \quad (01)$$

Where G_t denotes government expenditure, B_t represents government debt, T_t refers to government revenues, and r_t is the real interest rate. The variable S_t denotes the primary balance, which may reflect either a surplus or a deficit position.

Applying forward substitution, t=1, t=2... t=n (1) gives:

$$B_t= (1+r)^{-1}\, S_{t+1}+ (1+r)^{-1}B_{t+1} \quad (02)$$

$$B_t= (1+r)^{-2}\, S_{t+2}+ (1+r)^{-1}\, S_{t+1}+ (1+r)^{-2}B_{t+2} \quad (03)$$

$$Bt=\sum_{i=1}^{n}. (1+r)^{-i}\, S_{t+i}+ (1+r)\text{-}nB_{t+n} \quad (04)$$

Considering the limit as n approaches infinity:

$$B_t=\sum_{i=1}^{\infty}. (1+r)^{-i}S_{t+i}+\lim_{n\to\infty} E_t\, (1+r)^{-n}B_{t+n} \quad (05)$$

A core assumption of the Intertemporal Budget Constraint (IBC) is that the second term ensures the present value of public debt diminishes to zero as time approaches infinity:

$$\lim_{n\to\infty} E_t\, (1+r)^{-n}B_{t+n}=0 \quad (06)$$

Equation (1) can also be utilized to derive Equation (07), which expresses all variables as ratios of GDP. To simplify the presentation and avoid unnecessary complexity, we omit the time indices for the parameters r and g:

$$\Delta(B/Y)_t = [(r - g)/(1 + g)](B/Y)_{t-1} - (S/Y)_t \quad (07)$$

Where Y is nominal GDP, r is the real interest rate, and g is the real economic growth rate,

Equation (07) directly yields the commonly used expression for the primary balance, which ensures the stability of the debt-to-GDP ratio:

$$(S/Y)_t = ((r - g)/(1 + g))(B/Y)_{t-1} \quad (08)$$

Equation (08) can be utilized as a fiscal rule to determine the primary balance-to-GDP ratio necessary to sustain a constant debt-to-GDP ratio, under the assumption that the initial levels of public debt are deemed acceptable (Budina 2008). Following the methodology of (Burger, Ian, Jooste and Cuevas 2011), fiscal reaction function is specified in accordance with Equation (08) which facilitates the evaluation of the government's fiscal policy response to fluctuations in the level of public debt:

$$(S/Y)_t = \alpha(B/Y)_{t-1} +\varepsilon_t \quad (09)$$

Coefficient α should be approximately equal to (r - g)/(1 + g).

As specified by (Bohn 1998), governments often pursue cyclical fiscal policy in short-run demand stabilization, the output gap ($\hat{Y}$) can be added to the right side of Equation (09).

The representation of the fiscal reaction function is:

$$(S/Y)_t = \alpha_1 +\alpha_2(B/Y)_{t-1} +\alpha_3(\hat{y})_t+ \varepsilon_t \quad (10)$$

(Kia 2008) highlights that the underdeveloped nature of tax systems in many emerging economies poses a considerable obstacle to accurately evaluating fiscal policy sustainability. In resource-rich nations, particularly those reliant on oil production, government revenues extend beyond taxation alone. Therefore, limiting fiscal analysis to the tax-expenditure nexus may yield an incomplete or distorted view. Recognizing this, Kia's investigation into Iran's fiscal reaction function incorporated energy-derived revenues (denoted as ENERG) into the model, reflecting the fiscal significance of hydrocarbon income. The foundational specification of the fiscal reaction function, accounting for these dynamics, is articulated as follows:

$$(S/Y)_t = \alpha_1+\alpha_2\, (B/Y)_{t-1} +\alpha_3(\hat{y})_t+ \alpha_4(ENRGY/Y)_{t+}\, \varepsilon_t \quad (11)$$

Equation (9) can be expressed in an alternative form as follows:

$$S_t = \alpha_1 + \alpha_2 b_{t-1} + \alpha_3 \hat{y}_t + \alpha_4 energ_t + \varepsilon_t \quad (12)$$

With $s_t = (S/Y)_t$ primary balance to GDP ratio, $b_{t-1} = (B/Y)_{t-1}$ debt to GDP ratio, $\hat{y}_t = (\hat{Y}/Y)_t$ output gap to GDP ratio, energy=(ENRGY/Y)t energy income to GDP ratio, and, ε_t is a stochastic error term.

In order for fiscal policy to be considered sustainable, a positive correlation must exist between primary balance surpluses and public debt, which suggests that the coefficient α_2 should be positive.

The coefficients of ŷ and energy reflect the government's response under varying economic conditions. The coefficient of the output gap, α3, is expected to be less than zero ($\alpha 3 < 0$), indicating that when the output (y) is below its potential level (ŷ), i.e., $y/\hat{y} < 1$, tax revenues decline in proportion to the decrease in output. As a result, public debt will rise, and the primary balance surplus will fall. However, the coefficient of the output gap α_3 will equal one if tax rates eventually settle. If the coefficient $\alpha_4 \leq 0$, it means that all energy proceeds are used to finance government spending, which suggests that the policy is irresponsible if the coefficient $\alpha_4 \geq 1$, it means that the fiscal policy is fully responsible and that oil and gas revenue is used to pay down debt and/or invest it for future (Kia 2008).

3.2 Data Sources and Operational Definitions of Key Variables

This study utilizes annual data spanning the period from 1980 to 2023 to estimate Algeria's fiscal reaction function. All variables involved in the analysis are expressed as ratios relative to Gross Domestic Product (GDP).

Specifically, S represents the primary balance, defined as total government revenues minus total expenditures, excluding interest payments. Data for this variable are sourced from the World Bank (2025) database and the official records of the Algerian Central Bank.

b represents public debt, measured as the nominal accumulation of government debt within a given year. This data is also sourced from the World Bank (2025) and the official records of the Algerian Central Bank.

ŷ denotes the output gap, which represents the cyclical deviation between actual GDP and its potential level. This gap is estimated using the Hodrick-Prescott (HP) filter technique.

4. Study Results

The methodology employed in this study follows a two-step econometric process. First, unit root tests are conducted to assess the stationarity properties of the variables. Following this, the Autoregressive Distributed Lag (ARDL) Bounds Testing approach is applied. This method is particularly appropriate for investigating long-run relationships among variables that exhibit different integration orders

The empirical results provide partial validation of the study's central hypothesis. While a statistically significant positive relationship between the primary balance and public debt is confirmed, supporting the notion of fiscal sustainability, the magnitude of the response remains modest, suggesting that fiscal adjustment is gradual rather than immediate. Therefore, the hypothesis is partially validated: Algeria demonstrates fiscal sustainability, but the strength of the fiscal response falls short of what would be required for a more robust debt stabilization mechanism.

4.1 Stationarity Test

The Phillips-Perron (PP) test is employed in this study to determine the integration order of the variables. The outcomes, as detailed in Table 1, reveal that the public debt and energy income series possess unit roots at their levels, implying non-stationarity and classification as I(1) processes. Conversely, the primary balance and output gap variables are stationary in level form, signifying that they are integrated of order zero, I (0). Following first differencing, the unit root hypothesis for debt and energy income is rejected, confirming that these two variables become stationary and are thus integrated of order one.

Table 1. Unit Root Test Outcomes Based on the Phillips-Perron (PP) Method

variable	Level	First Difference	Order of integration
s	**-2.76****	**-**	**I(0)**
b	**-0.81**	**-7.38****	**I(1)**
enrgy	**-1.04**	**-7.04****	**I(1)**
y	**-2.78****	**-**	**I(0)**

Note: (**) indicate the null hypothesis' rejection at the 5% level of significance.

Source: Author's Calculation

4.2 Estimating the Parameters of the Fiscal Reaction Function

Based on the results of the unit root tests, both energy income and public debt are classified as I(1), while the primary balance and output gap are identified as I(0). Consequently, the Autoregressive Distributed Lag (ARDL) bounds testing approach, as proposed by Pesaran and Shin (2001), is deemed the most suitable method for estimating Algeria's fiscal reaction function. To determine the optimal lag length for the model, the Akaike Information Criterion (AIC) is utilized. Additionally, this study examines the existence of a long-term relationship among the variables. The outcomes of the ARDL bounds test, as presented in Table 3, indicate that the optimal model specification is ARDL (1, 2, 1, 2), with the lag structure offering the best fit for each variable. The ARDL representation of the fiscal reaction function is specified as follows:

$$\Delta s_t = \alpha_1+\alpha_2 s_{t-1}+\alpha_3 b_{t-1}+\alpha_4 y_{t-1}+\alpha_5 energ_{t-1}+\sum_{t=0}^{q1}.\Delta\beta_1 s_{t-i}+\sum_{t=0}^{q2}.\Delta\beta_2 b_{t-i}+\sum_{t=0}^{q3}.\Delta\beta_3 y_{t-i}+\sum_{t=0}^{q4}.\Delta\beta_4 energ_{t-i}+\varepsilon_t$$

Where:

- Δ denotes the first difference operator
- β1, β2, β3, β4: represent the coefficients of the short-run relationship
- α1, α2, α3, α4, α5: The coefficients represent the long-term relationship between the variable.
- Q: refers to the maximum lag length considered for the variables.

4.2.1 The bound Test (cointegration test)

Cointegration is tested using the bounds testing approach with Fisher's test statistic, which is compared against the critical values. The computed F-statistic for the model is 6.041, which exceeds the upper bound critical value of 3.67 at the 5% significance level (refer to Table 2). Therefore, the null hypothesis of no cointegration is rejected, indicating the presence of a long-term relationship among the variables in the fiscal reaction function model.

Table 2. Presents the results of the ARDL Bounds Test for the model

ARDL Bounds Test Sample Period: 1980–2023 Number of Observations: 42 Null Hypothesis (H_0): No long-term relationships exist		
Test Statistic	Value	K
F-statistic	6.041495	3
Critical Value Bounds		
Significance	Lower Bound	Upper Bound
10%	2.37	3.2
5%	2.79	3.67
2.5%	3.15	4.08
1%	3.65	4.66

Source: Author's Calculation

4.2.2 Estimation of Long-Run and Short-Run Dynamics

The results presented in Table 3 indicate that the primary balance surplus shows a statistically significant positive response to public debt at the 5% significance level. However, the magnitude of the effect is relatively small, implying that public debt remains sustainable. This suggests that the government adjusts to increases in public debt by improving the primary balance.

Specifically, a 1% rise in public debt results in a 0.076% increase in the primary balance, which indicates a weak connection between government debt and the primary surplus over the long term. This outcome suggests that Algeria has adopted a sustainable financial approach to managing public debt and is working toward generating primary surpluses to meet its debt service obligations and interest commitment.

The limited magnitude of the fiscal response can be attributed to several structural factors. First, Algeria's public expenditure is characterized by a high degree of rigidity, with current spending—particularly wages and subsidies—representing a large and politically sensitive share of total outlays, making downward adjustment difficult even during periods of fiscal stress. Second, the government's fiscal behavior has historically been procyclical, expanding expenditure during oil price booms without building sufficient structural buffers for periods of revenue contraction. Third, the predominance of hydrocarbon revenues over tax revenues reduces the automatic stabilizer effect typically associated with tax-based fiscal systems, thereby weakening the mechanical link between debt accumulation and primary balance adjustment.

These findings can be contextualised within a broader comparative framework involving oil-exporting economies with similar fiscal structures. Kia (2008) found that Iran's primary balance responds positively to public debt accumulation, reflecting a stronger fiscal adjustment than that observed in Algeria. Similarly, Burger et al. (2011) reported evidence of fiscal sustainability for South Africa, a resource-dependent economy subject to comparable commodity price volatility. By contrast, Algeria's estimated coefficient of 0.076 suggests a more subdued fiscal response, which may be attributable to the dominance of non-tax hydrocarbon revenues that reduce the government's incentive to implement structural fiscal consolidation measures. This comparison underscores the importance of institutional fiscal frameworks and revenue diversification strategies in determining the strength of fiscal adjustment in resource-rich economies.

The output gap coefficient is positive; however, it does not reach statistical significance at the 5% level, implying that Algeria's fiscal policy does not show a meaningful response to cyclical variations. This may suggest that fiscal policy is not adequately mitigating the accumulation of debt during economic cycles.

The coefficient of the energy variable, which represents oil and gas income as a percentage of GDP, is both positive and statistically significant. This suggests that energy income is being effectively allocated towards investment and debt reduction, reflecting a responsible fiscal approach by the Algerian government. In summary, the findings support the conclusion that Algeria's fiscal policy is both sustainable and prudent, particularly with respect to energy income. This is demonstrated by Algeria's use of energy-related fiscal surpluses from 2001 to 2012 to repay debt and finance public economic development initiatives.

Additionally, the short-run error correction results show that the estimated error correction coefficient is -0.55, statistically significant at the 5% level. This supports the existence of a

long-term equilibrium relationship and indicates that about 55% of any fiscal imbalance is corrected within a year following a shock.

Table 3. Coefficients of the Long-Term Relationship

variable	coefficient	Std. error	t-statistic	prob
b	0.076839	0.026209	2.931711	0.0062
energ	0.507355	0.206957	2.451506	0.0199
y	0.119827	0.061230	1.957002	0.0591
c	-0.146447	0.050888	-2.877819	0.0071
S=-0.146+ 0.076b+0.507energ+0.119y				

Source: Author's Calculation

Table 4. Coefficients of the Short-Run Relationship

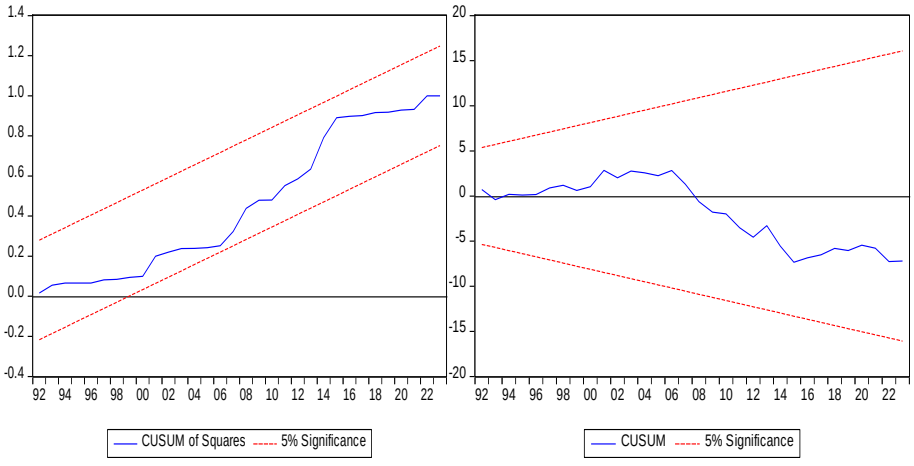
variable	coefficient	Std.error	t-statistic	prob
D(B)	-0.068809	0.038446	-1.789739	0.0830
D(B(-1))	-0.084236	0.043958	-1.916291	0.0643
D(ENRGY)	0.961124	0.092729	10.36485	0.0000
D(Y)	-0.038125	0.052099	-0.731775	0.4696
D(Y(-1))	-0.144982	0.045931	-3.156494	0.0035
CointEq(-1)*	-0.553721	0.094985	-5.829529	0.0000

Source: Author's Calculation

4.2.3 Model Diagnostic and Stability Tests

To evaluate the stability of the model, the cumulative sum of recursive residuals (CUSUM) and the cumulative sum of squares of recursive residuals (CUSUMQ) are utilized. Figure 4 presents the results, showing the crossing of the linear medium within the critical threshold limits. The long-run coefficients of the model's variables are found to be stable at the 5% significance level.

Figure 4. Stability Tests: CUSUM and CUSUMQ Analysis



To evaluate the robustness of the estimated model, a series of statistical tests were conducted: (1) the Breusch-Godfrey test to identify serial correlation in the residuals, (2) the Breusch-Pagan test to check for heteroscedasticity in the residuals, and (3) the Jarque-Bera test to assess the normality of the residuals. The outcomes of these tests are detailed below.

Table 5. Diagnostic Test Results

Test	Null hypothesis	Test statistic	P-value	Conclusions
Jarque–Bera	Residuals are normally distributed	0.40	0.807	Since the p-value is greater than the 5% significance level, it can be concluded that the residuals of the model are normally distributed."
Breush-gofrey Serial correlation LM	No autocorrelation	0.27	0.764	Since the p-value is greater than the 5% significance level, it can be concluded that the model does not suffer from autocorrelation.
Breusch Pagan–Godfrey	No heteroscedasticity	8.805	0.0455	The p-value exceeds the 5% significance level, so there is no heteroscedasticity in the model

Source: Author's Calculation

CONCLUSION:

This research explored the sustainability of fiscal policy in Algeria over the period 1980–2023, with a particular emphasis on the long-term viability of public debt. The study estimated Algeria's fiscal reaction function using the ARDL bounds testing approach, incorporating public debt, the output gap, and energy revenues as key explanatory variables.

The empirical results confirm a statistically significant long-term relationship between the primary balance and public debt, indicating that fiscal authorities respond to increasing debt levels by generating primary surpluses. However, the magnitude of this response remains modest, with a 1% rise in public debt leading to only a 0.076% improvement in the primary balance. This subdued adjustment reflects the structural rigidity of Algeria's public expenditure and its pronounced dependence on hydrocarbon revenues. Furthermore, Algeria's management of oil and gas revenues is found to be prudent and sustainable, with energy income being effectively channeled toward debt reduction and public investment, particularly during the period 2001–2014. The policy implications derived from these findings are discussed in detail in Section 5.

Nevertheless, the study acknowledges certain limitations. The analysis does not account for potential structural breaks associated with major external shocks such as the sharp oil price decline of 2014 or the COVID-19 pandemic, which may have altered the underlying fiscal dynamics. Consequently, the estimated coefficients should be interpreted as average responses over the full sample period rather than as stable structural parameters. Future research could address these limitations by conducting sub-period analyses or applying time-varying parameter models to capture potential shifts in fiscal behavior over time.

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