Macroeconomic Analysis and GDP Forecasting for Algeria through 2027

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Abstract:

This paper provides a macroeconomic analysis of Algeria's gross domestic product dynamics from 1980 to 2025 with projections through 2027, emphasizing the structural dependence on hydrocarbon revenues and external economic conditions. Using annual data and an ARIMAX(1,1,0) model retaining oil price and exchange rate as exogenous predictors. The model forecasts nominal GDP at 268.4 billion USD (2026) and 296.8 billion USD (2027), with an oil price elasticity of 0.17. The findings underscore that projected growth depends primarily on favorable external conditions rather than structural transformation, reinforcing the urgency of economic diversification.

Keywords: GDP forecasting; Algeria; ARIMAX model; oil price; exchange rate; economic diversification; Box-Jenkins methodology.

Jel Classification Codes: C22, C53, E17, O13, Q43

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1. INTRODUCTION

Algeria's economic structure is emblematic of resource-dependent economies, where macroeconomic performance is largely determined by developments in the hydrocarbon sector. Over several decades, oil and natural gas have constituted the backbone of the country's export revenues and fiscal resources, creating a strong linkage between global energy markets and domestic economic activity. This structural dependency implies that fluctuations in international oil prices and exchange rate dynamics exert a decisive influence on GDP growth, fiscal stability, and overall macroeconomic performance.

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In such a context, analyzing GDP trends requires more than a technical forecasting exercise; it necessitates a comprehensive understanding of the macroeconomic environment and the structural forces shaping economic outcomes. The objective of this study is therefore twofold: first, to provide a macroeconomic interpretation of Algeria's GDP trajectory toward 2027, focusing on the role of external drivers and their implications for economic sustainability; and second, to demonstrate the critical importance of rigorous model diagnostic validation in applied econometric research. By identifying and correcting five fundamental estimation failures in an initial ARIMAX(1,1,1) specification, this paper contributes to the broader methodological literature on time series modeling in resource-dependent economies.

The paper makes three principal contributions to the existing literature. First, it provides a formal diagnostic analysis of the structural defects present in the original ARIMAX specification, including the detection of a non-invertible moving average polynomial, near-singular Hessian matrix, and over-parameterization bias. Second, the derivation of ARIMAX(1,1,0) model offers a parsimonious and statistically sound forecasting framework that retains the theoretically grounded exogenous variables of oil price and exchange rate while eliminating redundant and insignificant regressors. Third, the paper situates its quantitative findings within a broader macroeconomic narrative, linking model parameters to Algeria's structural vulnerabilities and the policy imperatives of the National Economic Diversification Strategy (2020–2030).

2. Macroeconomic context and literature review

2.1 Algeria's Economic Structure and Hydrocarbon Dependency

Since gaining independence in 1962, Algeria has followed a development path deeply influenced by state-led economic planning and the strategic exploitation of its natural resources. In the early decades after independence, the country adopted a centralized economic model characterized by large-scale nationalizations, strong public sector dominance, and significant investment in heavy industry. The nationalization of hydrocarbons in 1971 marked a decisive

turning point, positioning oil and gas as the central pillars of economic growth and fiscal stability. While this model allowed Algeria to accumulate substantial revenues during periods of high oil prices and to finance major social and infrastructure programs, it also entrenched a long-term structural dependence on a single sector.

At the heart of this system is Sonatrach, the national oil and gas company that controls the majority of exploration, production, and export activities. Sonatrach plays a dominant role in generating foreign exchange earnings and government revenues, making it a critical driver of national income. This concentration of economic power within the hydrocarbon sector has created a strong linkage between external energy markets and domestic macroeconomic performance. As a result, fluctuations in global oil prices are quickly transmitted into public finances, investment levels, and overall economic growth.

Such a structure has contributed to the emergence of Dutch Disease symptoms, whereby the dominance of the hydrocarbon sector crowds out other productive activities. During periods of high oil revenues, capital and labor tend to shift toward the energy sector and related rent-generating activities, while the real exchange rate appreciates, reducing the competitiveness of non-oil exports. This dynamic has weakened the development of manufacturing and agriculture, leading to a persistent reliance on imports to meet domestic demand. Over time, this import dependency has further limited the expansion of a diversified and resilient productive base.

The vulnerability associated with this economic configuration has been repeatedly exposed during major oil price shocks, particularly in 1986, 2014–2016, and 2020. Each of these episodes led to significant declines in export revenues and fiscal resources, triggering macroeconomic instability and forcing policy adjustments. The 1986 oil price collapse, for instance, initiated a period of economic restructuring and gradual liberalization. More recent shocks, especially the downturn in 2020 linked to global economic disruptions, have once again underscored the fragility of a growth model heavily dependent on volatile commodity markets.

A critical indicator of Algeria's fiscal vulnerability is the breakeven oil price, the price per barrel required to balance the government budget. Estimates from the International Monetary Fund (Fund, 2024) place Algeria's fiscal breakeven price at approximately 120–130 USD per barrel, substantially above prevailing market prices. This persistent gap between the breakeven price and actual market prices implies chronic fiscal deficits that are financed through reserve drawdowns and monetary expansion, further constraining the macroeconomic space available for diversification investment. The Revenue Regulation Fund (Fonds de Régulation des Recettes, FRR), established in 2000 as a stabilization mechanism, has been progressively depleted since 2014, leaving limited fiscal buffers against future oil price shocks.

In response to these recurring challenges, the Algerian authorities have introduced policy frameworks aimed at promoting economic diversification and reducing reliance on hydrocarbons. The National Economic Diversification Strategy (2020–2030) seeks to develop alternative sectors such as agriculture, manufacturing, mining, and renewable energy, while improving the business environment and encouraging private investment. The strategy also emphasizes export diversification and the creation of higher value-added activities as essential components of long-term growth. Despite these efforts, Algeria's economic structure continues to reflect a classic case

of resource dependence, where hydrocarbon revenues remain the primary engine of growth and a key source of macroeconomic vulnerability.

2.2 GDP Determinants in Oil-Exporting Economies

The relationship between oil price fluctuations and GDP in petroleum-dependent economies finds its theoretical cornerstone in Hamilton's seminal framework (Hamilton, 1983) . Hamilton demonstrated that post-World War II US recessions were systematically preceded by oil price increases, establishing that oil shocks are not merely supply-side nuisances but primary drivers of aggregate output. For oil-exporting nations, however, the transmission mechanism operates inversely and asymmetrically: while rising prices generate positive wealth effects through increased fiscal revenues, the contractionary impact of price collapses tends to be more abrupt and persistent due to rigid expenditure patterns. This asymmetric transmission effect is particularly pronounced in rentier states, where GDP remains coupled to oil revenue streams via government spending multipliers. Extending this logic, (Moussous & Saouli, 2021) provide empirical evidence from Algeria, estimating short-run and long-run GDP elasticities to hydrocarbon revenues using an ARDL bounds testing approach. Their findings reveal a cointegrating relationship wherein a 10% decline in oil revenues reduces non-oil GDP by approximately 6.3% within two quarters, underscoring the vulnerability of domestically oriented sectors to external terms-of-trade shocks.

Furthermore, the role of exchange rate dynamics in managed float regimes constitutes a critical, yet often underemphasized, determinant of GDP transmission. As formalized by Engle (1982) in the context of conditional heteroskedasticity, exchange rate volatility in managed float systems amplifies the pass-through from oil prices to domestic activity. Unlike fixed pegs that buffer external shocks or pure floats that absorb them via nominal adjustments, managed floats generate conditional variance patterns that distort investment signals and complicate monetary policy responses. In such regimes, oil revenue fluctuations first affect the real exchange rate through the spending effect, then feed into non-tradable GDP via the Balassa-Samuelson channel. Finally, econometric modeling of these relationships must confront the statistical properties of the underlying series. (Bourbonnais & Terraza, 2022) highlight that macroeconomic aggregates in oil-exporting panels—particularly the ratio of oil revenues to GDP, real exchange rates, and fiscal balances—frequently behave as integrated processes of order two. Their panel cointegration framework demonstrates that neglecting second-order integration leads to spurious inference regarding the persistence of oil price shocks.

2.3 Time Series Approaches to GDP Forecasting

Forecasting gross domestic product in oil-exporting economies poses significant methodological challenges due to the presence of structural breaks, nonlinear adjustment mechanisms, and the exogenous nature of international oil price fluctuations. Unlike diversified economies, where output dynamics are largely shaped by domestic productive structures, hydrocarbon-dependent economies exhibit pronounced sensitivity to external commodity market shocks. This structural characteristic complicates the application of conventional forecasting frameworks, particularly when abrupt shifts in global energy markets generate regime changes that standard linear models struggle to capture. Traditional univariate approaches, such as

autoregressive integrated moving average (ARIMA) models, remain useful for identifying stochastic trends and short-term persistence in GDP series; however, they are limited in their ability to account for the asymmetric responses to oil price shocks documented in Hamilton's seminal work.

In response to these limitations, the forecasting literature has increasingly shifted toward multivariate time-series frameworks capable of explicitly modeling the joint interaction between oil prices, exchange rates, fiscal policy variables, and aggregate output. Among these, vector autoregression (VAR) models and their structural extensions have emerged as dominant analytical tools. Empirical evidence consistently suggests that negative oil price shocks tend to generate larger and more persistent contractions in output than the expansionary effects associated with positive shocks of similar magnitude. This asymmetry reflects adjustment rigidities, delayed fiscal responses, and structural dependencies that characterize many resource-exporting economies. Such nonlinearities are often more effectively captured through asymmetric error correction models, which allow for differentiated adjustment paths depending on the direction and magnitude of external disturbances.

For economies operating under managed exchange rate regimes, the forecasting challenge is further complicated by exchange rate volatility and its interaction with macroeconomic performance. Building on Engle's ARCH framework, recent studies have extended volatility modeling to multivariate GARCH-in-mean specifications, where exchange rate uncertainty enters directly into the conditional mean equation for GDP growth. Such models are particularly relevant for economies where monetary authorities actively intervene in foreign exchange markets, generating persistence and regime-dependent volatility patterns that conventional linear frameworks fail to address adequately. An additional econometric complication arises from the nonstandard integration properties frequently observed in macroeconomic series for hydrocarbon-dependent economies. To address this issue, recent methodological developments have incorporated autoregressive distributed lag (ARDL) models adapted for higher-order integration, as well as dynamic ordinary least squares estimators that incorporate leads and lags to correct for endogeneity and serial correlation.

3. DATA AND VARIABLES

3.1 Data Source and Sample Period

The empirical analysis employs annual data spanning from 1980 to 2025, yielding a total of 46 observations that encompass key phases of Algeria's economic evolution, from the early period of hydrocarbon-driven industrialization through successive oil price cycles and the implementation of structural adjustment programs. Nominal GDP and the DZD/USD exchange rate are sourced from the Algerian Ministry of Finance and the Bank of Algeria. Oil prices correspond to the Sahara Blend benchmark and are obtained from the Organization of the Petroleum Exporting Countries (OPEC). Inflation data are drawn from the National Office of Statistics (ONS). The use of annual data is appropriate given the structural nature of GDP dynamics and the absence of consistent higher-frequency data across the full sample period.

3.2 Variable Definitions and Transformations

The endogenous variable is the natural logarithm of nominal GDP, denoted Log(GDPt). This logarithmic transformation stabilizes variance, reduces scale effects, and linearizes multiplicative relationships, thereby improving the statistical properties of the estimated model. Nominal GDP is retained—rather than real GDP—because the model incorporates inflation as a separate regressor, thereby permitting a decomposition of nominal movements into quantity and price components within the estimating framework.

The first exogenous variable is the Sahara Blend oil price per barrel, denoted oil_price_t. This series serves as a proxy for external revenue shocks in Algeria's hydrocarbon-dependent economy, where oil constitutes approximately 90% of total export earnings. Following Hamilton's (1983) asymmetric framework, the level of oil price is retained to capture the contemporaneous revenue effects on national income. The second exogenous variable is the nominal DZD/USD exchange rate, denoted exchange_rate. This variable captures external competitiveness and currency valuation effects, as changes in the exchange rate influence import costs, purchasing power, and broader macroeconomic stability. Under Algeria's managed float regime, as discussed by Engle (1982), exchange rate volatility serves as a transmission channel through which oil price shocks propagate into domestic economic activity. The third variable, the annual consumer price inflation rate ($Taux_inf_t$), was initially included to reflect domestic price dynamics and macroeconomic stability conditions; however, as discussed in Section 5, it proves statistically insignificant in the GDP equation and is subsequently excluded from the corrected specification. All exogenous variables are introduced in their levels, consistent with the ARIMAX framework wherein the differencing operator is applied only to the endogenous variable's ARIMA component.

3.3 Descriptive Statistics

Table 1 reports descriptive statistics for all variables over the full 1980–2025 sample period. The substantial standard deviation of GDP (81.63 billion USD) relative to its mean (117.84 billion USD) confirms Algeria's volatile growth path driven by hydrocarbon dependence. Oil prices range from a minimum of $12.62 to a maximum of $111.80 per barrel, capturing major historical commodity cycles. The exchange rate has depreciated dramatically over the sample, from 4.83 to 138.40 DZD per USD. Inflation peaks at 31.67% during the civil conflict of the 1990s, while registering a mean of 10.42% over the full period. Overall, each exogenous variable exhibits sufficient temporal variation to identify its impact on log(GDP) within the ARIMAX framework.

Table 1: Descriptive Statistics of GDP and Related Variables (1980–2025)

Variable	N	Mean	Std. Dev.	Min	Max
GDP (USD billion)	46	117.84	81.63	42.30	238.70
log(GDP)	46	11.47	0.72	10.65	12.38
Oil Price (USD/barrel)	46	44.23	33.17	12.62	111.80
Exchange Rate (DZD/USD)	46	67.41	42.88	4.83	138.40
Inflation Rate (%)	46	10.42	12.31	0.34	31.67

Source: Prepared by the author based on Ministry of Finance, Bank of Algeria, OPEC, and ONS data.

4. METHODOLOGY

4.1 Stationarity Testing

The stationarity of all time series is assessed using the Augmented Dickey-Fuller (ADF) test (Dickey & Fuller, 1979), which evaluates the null hypothesis of a unit root against the alternative of trend-stationarity. The test regression includes a constant and a linear trend, and takes the form:

$$\Delta y_t = \alpha + \beta t + \gamma y_{t-1} + \Sigma \delta_i \Delta y_{t-i} + \varepsilon_t$$

where the null hypothesis H_0: $\gamma = 0$ indicates the presence of a unit root. Lag length is selected by minimizing the Akaike Information Criterion (AIC), ensuring that residual serial correlation is adequately removed without over-fitting. A series is classified as integrated of order d, denoted I(d), if it requires d rounds of differencing to achieve stationarity. Consistent with the requirements of the ARIMAX specification, exogenous regressors are introduced in their original levels, while differencing is applied only within the ARIMA component governing the endogenous variable.

4.2 ARIMAX Model Specification

The general ARIMAX(p,d,q) model with k exogenous regressors can be expressed as:

$$\Phi(B)\Delta^d y_t = c + \Phi(B)x_t + \Theta(B)\varepsilon_t$$

Where B is the lag operator, $\Phi(B) = 1 - \phi_1 B - \phi_2 B^2 - \cdots - \phi_p B^p$ is the autoregressive polynomial of order p, $\Theta(B) = 1 + \theta_1 B + \theta_2 B^2 + \cdots + \theta_q B^q$ is the moving average polynomial of order q, Δ^d denotes the d-th order differencing operator, x is a vector of exogenous regressors with associated parameter vector Φ, and ε is a white noise error process. The ARIMAX(1,1,0) model with two exogenous regressors is specified as:

$$\Delta log(GDPt) = c + \beta_1 \cdot oil_price_t + \beta_2 \cdot exchange_rate_t + \varphi_1 \cdot \Delta log(GDPt_{-1}) + \varepsilon_t$$

Where Δ denotes the first difference operator, log(GDPt) is the natural logarithm of nominal GDP, oil_price_t is the Sahara Blend price per barrel, $exchange_rate_t$ is the nominal DZD/USD rate, φ_1 is the autoregressive parameter capturing GDP growth persistence, and ε_t is a white noise innovation process. The model contains no moving average component, thereby eliminating the invertibility concerns present in the original specification.

4.3 Model Selection and Diagnostic Criteria

Model selection employs the Akaike Information Criterion (AIC) and the Bayesian Information Criterion (BIC). The AIC is defined as AIC = -2ℓ + 2k, where ℓ denotes the maximized log-likelihood and k the number of estimated parameters. The BIC imposes a more severe penalty for model complexity, defined as BIC = -2ℓ + k·ln(n), where n is the sample size. The principle of parsimony favors specifications with fewer parameters when information criteria differences are marginal. All estimations use maximum likelihood with numerical Hessian optimization.

Residual adequacy is assessed via three complementary tests. The Ljung-Box portmanteau test (Box & Jenkins, 1976) evaluates whether the residual autocorrelation function is consistent with white noise. The Jarque-Bera test (Jarque & Bera, 1987) assesses departure from normality based on skewness and excess kurtosis measures. Engle's ARCH Lagrange Multiplier test (Engle, 1982) detects conditional heteroscedasticity in the residual variance. Given the expected non-normality in short macroeconomic panels with structural breaks, Newey-West heteroscedasticity and autocorrelation consistent (HAC) standard errors (Newey & West, 1987) are employed to ensure robust statistical inference.

4.4 Forecasting Procedure

Two-year-ahead GDP forecasts for 2026 and 2027 follow a two-step procedure that mirrors the sequential structure of the ARIMAX model. In the first step, appropriate ARIMA sub-models are estimated separately for each exogenous variable—oil price and exchange rate—to generate independent short-horizon forecasts of their future trajectories. In the second step, these projected exogenous values are fed as inputs into the ARIMAX(1,1,0) GDP equation to obtain conditional GDP forecasts. Final GDP level forecasts are recovered by exponentiating the predicted log(GDP) values. Ninety-five percent prediction intervals are constructed from the conditional forecast error variance, accounting for both parameter estimation uncertainty and the stochastic properties of the error process.

5. EMPIRICAL RESULTS

5.1 Unit Root Test Results

Table 2 reports the ADF unit root test results for all variables in the model. At the 5% significance level, log(GDP) and oil price are non-stationary in levels but stationary in first differences, confirming I(1) behavior consistent with the majority of macroeconomic time series. The exchange rate exhibits an unusual integration pattern, requiring second differencing to achieve stationarity and thereby revealing an I(2) process. This finding is attributable to Algeria's managed float regime and the persistent nominal depreciation trend of the dinar over the sample period, which generates a sustained drift that survives first differencing. The inflation rate is marginally non-stationary at levels (p = .053)—just above the conventional 5% threshold—but becomes decisively stationary after first differencing, confirming I(1) classification. The I(2) behavior of the exchange rate has important implications for model specification, as noted by (Bourbonnais & Terraza, 2022), and warrants careful treatment to avoid spurious inference.

Table 2: Augmented Dickey-Fuller Unit Root Test Results

Variable	Level	p-value	Δ1st Diff.	p-value	Δ2nd Diff.	Order
log(GDP)	-1.847	.168	-4.312	.001	—	I(1)

Variable	Level	p-value	Δ1st Diff.	p-value	Δ2nd Diff.	Order
Oil Price	-2.103	.241	-4.876	.000	—	I(1)
Exchange Rate	-0.983	.761	-2.541	.107	-4.021	I(2)
Inflation Rate	-2.912	.053	-5.234	.000	—	I(1)

Source: Prepared by the author.

Note. ADF test includes a constant and trend. Lag length selected by AIC. Critical values at 5%: -3.52 (level), -2.93 (first difference). The inflation rate level p-value of .053 is marginally above the 5% threshold; first differencing decisively rejects the null, confirming I(1) classification. Δ = first difference operator.

5.2 The Model: ARIMAX(1,1,0) with Two Exogenous Variables

The corrected specification eliminates the MA(1) component on the grounds that its estimated coefficient lies on the non-invertibility boundary ($|\theta| = 1$), rendering the original specification theoretically inadmissible. Parsimony further dictates the removal of the inflation variable, which fails to achieve conventional significance thresholds and whose retention introduces unnecessary parameter uncertainty. The resulting ARIMAX(1,1,0) model with two exogenous regressors constitutes a theoretically grounded and empirically parsimonious specification aligned with the structural characteristics of the Algerian economy. Table 3 presents the model estimates.

Table 3: ARIMAX(1,1,0) Model Coefficient Estimates With Two Exogenous Variables

Parameter	Coefficient	Std. Error	z	p	Sig.
AR.L1 (φ)	0.4821	0.1473	3.27	.001	**
Oil Price (β)	0.0038	0.0008	4.75	< .001	***
Exchange Rate (β)	-0.0094	0.0032	-2.94	.003	**
Sigma² (σ^2)	0.0024	0.0007	3.43	.001	**
Log-Likelihood	68.97				
AIC	-129.94				
BIC	-122.68				

Source: Prepared by the author.

*Note: Estimation by maximum likelihood. N = 44 effective observations. All parameters are statistically significant at p < .01. Sigma² is precisely estimated (Std. Error = 0.0007), confirming resolution of the Hessian ill conditioning. AIC = -129.94 is lower (better) than the original model AIC = -128.86. ** p < .01; *** p < .001.*

Table 4: Model Selection Comparison Across Alternative ARIMAX Specifications

Model Specification	Params	AIC	BIC	Status
ARIMAX(1,1,1) — 3 variables [Original]	6	-128.86	-118.14	Rejected
ARIMAX(1,1,0) — 3 variables	5	-128.31	-119.42	Rejected
ARIMAX(1,1,0) — 2 variables [Corrected]	**4**	**-129.94**	**-122.68**	**Selected**
ARIMAX(2,1,0) — 2 variables	5	-128.67	-120.14	Inferior
ARIMAX(0,1,0) — 2 variables	3	-121.38	-115.82	Inferior

Source: Prepared by the author.

Note: All models estimated on the same sample (N = 44). The corrected ARIMAX(1,1,0) with two exogenous variables achieves the lowest AIC (-129.94) and second-lowest BIC (-122.68), while maintaining all parameters

statistically significant and resolving all structural estimation failures. Params = number of estimated parameters including sigma².

The diagnostic adequacy of the corrected specification is confirmed through standard residual tests. The Ljung-Box portmanteau statistic yields a p-value of 0.72, indicating no significant residual autocorrelation up to lag 10. The ARCH-LM test produces a p-value of 0.34, confirming the absence of conditional heteroscedasticity in the residual variance. While the Jarque-Bera test remains marginally significant (p = .04), reflecting persistent non-normality attributable to structural breaks in the sample period—particularly the 1986 oil counter-shock, the 1994 IMF adjustment program, and the 2020 COVID-19 pandemic—the use of Newey-West HAC standard errors ensures that inference remains valid under non-Gaussian conditions. Critically, all estimated parameters are now statistically significant at the 1% level, the Hessian matrix is well-conditioned, and the variance parameter is precisely estimated with a standard error of 0.0007, resolving all five structural defects identified in the original specification.

5.3 Economic Interpretation of the Model

The ARIMAX(1,1,0) model produces three economically interpretable and theoretically grounded parameters. The oil price coefficient ($\beta = 0.0038$) implies that a one-dollar increase in the Sahara Blend barrel price is associated, ceteris paribus, with a 0.38% increase in the level of GDP. Given a 2025 baseline GDP of approximately 238.7 billion USD, this translates to a marginal oil price elasticity of approximately 0.17: meaning that a 10% increase in oil prices yields a 1.7% increase in nominal GDP. This elasticity is somewhat lower than the 0.24 estimated by Moussous and Saouli (2021) using VECM methods, a difference likely attributable to different estimation horizons and the exclusion of fiscal transmission channels in the present parsimonious specification.

The exchange rate coefficient ($\beta = -0.0094$) indicates that a one-unit nominal depreciation of the dinar (increase in DZD/USD) reduces GDP by approximately 0.94%. This negative relationship reflects the import dependency of Algeria's non-hydrocarbon sector: as the dinar depreciates, the USD-denominated value of domestic production falls, and intermediate goods imports become more costly, compressing real output. The direction of this effect is consistent with Dutch Disease theory, wherein exchange rate depreciation exacerbates the structural disadvantage of non-tradable sectors.

The autoregressive term ($\varphi = 0.48$) confirms moderate GDP growth persistence: approximately half of any deviation from trend growth in year t carries forward into year t+1. This degree of persistence is consistent with the delayed pass-through of oil revenue cycles into public investment and consumption, which typically operates with a one-to-two-year lag through budget allocation processes.

These estimates can be contextualized against international benchmarks. The International Monetary Fund's World Economic Outlook (2024) projects Algeria's real GDP growth at 3.1% for 2025 and 2.8% for 2026: substantially below the nominal growth rates implied by the ARIMAX model. However, this discrepancy is largely attributable to the distinction between nominal and real GDP: the model's 12.4% nominal growth forecast for 2026 incorporates both real output expansion and the GDP deflator effect associated with rising oil prices. When adjusted

for projected inflation of approximately 7–8%, the implied real growth rate of approximately 4–5% is more consistent with, though still moderately above, IMF projections: a difference that may reflect the model's relatively optimistic oil price assumptions.

6. GDP forecast results and macroeconomic implications

6.1 Forecast Results

Table 5 presents the GDP forecast results from the ARIMAX(1,1,0) model for 2026 and 2027, including point forecasts, 95% confidence intervals, and implied annual growth rates.

Table 5: GDP Forecast Results: ARIMAX(1,1,0) Model (2025–2027)

Year	GDP (Billion USD)	95% Confidence Interval	Growth Rate	Oil Price (USD/bbl)	Rate (DZD/$)
2025	238.70	[Actual]	Baseline	Actual	Actual
2026	268.4	[241.7 - 298.1]	+12.4%	66.68	127.64
2027	296.8	[257.3 - 342.2]	+10.6%	70.79	124.94

Source: Prepared by the author.

Note. GDP figures in nominal USD billions. Confidence intervals are at the 95% level, constructed from the conditional forecast error variance. Oil price and exchange rate inputs derived from ARIMA sub-model forecasts (Table 3). Growth rates calculated relative to the prior year actual/forecast.

The model projects nominal GDP at 268.4 billion USD in 2026 and 296.8 billion USD in 2027, implying annual nominal growth rates of approximately 12.4% and 10.6%, respectively. These forecasts are conditional on projected Sahara Blend oil prices of $66.68 per barrel (2026) and $70.79 per barrel (2027), alongside a modest nominal appreciation of the dinar from 127.64 to 124.94 DZD/USD. The widening confidence intervals from [241.7, 298.1] in 2026 to [257.3, 342.2] in 2027 reflect the accumulation of forecast uncertainty over the horizon, driven by the compounding of errors from both the exogenous variable sub-models and the GDP equation itself.

6.2 Macroeconomic Policy Implications

The model's findings carry direct and uncomfortable policy implications for Algeria's fiscal framework. The strong positive GDP response to oil price movements reinforces the urgency of the economic diversification agenda: a model in which nominal GDP growth depends primarily on a projected $4 increase in the oil price per barrel is inherently fragile. The 2026–2027 forecasts presented here are optimistic precisely because they assume rising oil prices; a return to the conditions of the 2014–2016 price collapse or the 2020 COVID-19 shock would materially reduce, and potentially reverse, these projections.

Beyond the immediate forecast horizon, the model results illuminate the structural constraints facing Algeria's fiscal architecture. The Revenue Regulation Fund (Fonds de Régulation des Recettes, FRR), which served as the primary fiscal buffer during the commodity boom of the 2000s, has been effectively depleted since 2017. In the absence of this stabilization mechanism, any oil price downturn would translate directly into fiscal contraction, with cascading effects on public investment, employment, and social transfers. The model's sensitivity

analysis suggests that a return to 2020 oil price levels (approximately $40 per barrel) would reduce projected 2027 GDP by approximately 15–18%, effectively erasing the entirety of forecast growth.

The exchange rate's negative GDP effect further argues for careful management of foreign exchange policy. Excessive depreciation of the dinar, while potentially boosting hydrocarbon revenues in local currency terms, reduces nominal GDP in USD terms and increases the cost of imported capital goods required for diversification investment. The estimated exchange rate elasticity of -0.0094 suggests that a 10% depreciation reduces nominal GDP by approximately 0.94% a modest but economically meaningful effect that compounds over multi-year horizons.

The National Economic Diversification Strategy (2020–2030) identifies agriculture, renewable energy, digital services, and pharmaceutical manufacturing as priority sectors for reducing hydrocarbon dependency. However, the model's autoregressive coefficient ($\varphi_1 = 0.48$) implies substantial growth persistence, meaning that the structural transformation required to alter GDP's fundamental sensitivity to oil price movements will manifest only gradually over multiple economic cycles. Policy interventions must therefore operate on dual time horizons: short-term fiscal prudence and reserve accumulation to manage oil price volatility, and long-term institutional reforms to fundamentally alter the economy's productive structure and reduce the oil price elasticity of GDP.

6.3 Limitations

Several limitations of the present analysis warrant explicit acknowledgment. The sample of 46 annual observations, while spanning four decades of Algerian economic history, limits the statistical precision of parameter estimates and constrains the model's ability to disentangle the effects of multiple overlapping structural breaks. The persistent non-normality of residuals (Jarque-Bera p = .04 in the corrected model) suggests the presence of major structural shifts: the 1986 oil counter-shock, the 1994 IMF adjustment program, the 2000s commodity boom, and the 2020 COVID-19 pandemic, that are not explicitly modeled within the linear ARIMAX framework. The unconventional I(2) behavior of the exchange rate, while statistically supported, may reflect regime-specific policy interventions rather than a stable underlying data-generating process, introducing additional uncertainty into long-run projections. Finally, the two-step forecasting procedure compounds errors from the exogenous variable sub-models into the final GDP forecast, a limitation that could be addressed through joint estimation in a structural VAR framework.

7. Conclusion

This study set out to forecast Algeria's nominal GDP through 2027. Three substantive economic findings emerge from the model. First, the oil price elasticity of GDP is estimated at approximately 0.17, meaning that a 10% increase in oil prices yields a 1.7% increase in nominal GDP. This positive relationship underscores the continued hydrocarbon dependence of the Algerian economy. Second, the exchange rate coefficient of -0.0094 reveals that nominal depreciation of the dinar reduces GDP in USD terms—a finding that highlights the import-intensive nature of Algeria's non-oil sector and the limitations of exchange rate devaluation as a development tool. Third, the statistical insignificance of inflation as a GDP predictor indicates

that consumer price dynamics in Algeria are largely decoupled from output growth, reflecting the pervasive influence of administrative price controls and subsidized public goods rather than market-driven inflation transmission mechanisms. The model projects nominal GDP at 268.4 billion USD in 2026 and 296.8 billion USD in 2027, conditional on oil prices of $66.68 and $70.79 per barrel, respectively.

From a methodological perspective, this paper illustrates the critical importance of systematic model diagnostic validation as a prerequisite for credible applied econometrics. The original specification's five structural defects, if left uncorrected, would have produced forecasts that appear numerically plausible but rest on an unstable statistical foundation. The model not only achieves better information criteria (AIC = -129.94 versus -128.86 for the original) but eliminates the fundamental identification problems that rendered the original estimates unreliable.

From a policy perspective, the results carry a sobering message for Algeria's economic diversification agenda. A model in which projected GDP growth depends primarily on a forecast $4 increase in the oil price per barrel is inherently fragile: a return to the price collapse conditions of 2014–2016 or 2020 would erase these gains. The model thus serves as a quantitative reminder that diversification is not merely a desirable long-term objective but an urgent short-term necessity. Reducing the GDP elasticity to oil price movements requires structural shifts: expanding non-hydrocarbon exports, deepening domestic industrial integration, and gradually liberalizing the exchange rate regime to allow relative prices to signal resource allocation more efficiently.

Future research should extend this analysis in three directions. First, structural break models or time-varying parameter specifications could explicitly date and estimate the impact of major economic shocks on the GDP-oil price relationship. Second, nonlinear ARIMA extensions such as threshold autoregressive or GARCH-X models would address the volatility clustering and asymmetric adjustment evident in the residual diagnostics. Third, as data availability improves, incorporating institutional and governance indicators such as public financial management quality or the efficiency of non-hydrocarbon revenue mobilization could enhance forecast accuracy and policy relevance. For now, the ARIMAX(1,1,0) model provides a statistically sound and economically interpretable basis for short-to-medium-term GDP forecasting in Algeria, while its estimated fragility reinforces the case for fundamental economic transformation beyond the hydrocarbon sector.

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