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Trade Openness and External Trade Dynamics in Algeria: A Time-Series Analysis of Exports, Imports, and Trade Balance (1990–2024)

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Abstract:

This study examines the impact of trade openness on Algeria's foreign trade performance over the period 1990–2024. It focuses on the dynamics of exports, imports, and the trade balance within a time-series framework. To capture both short-run adjustments and long-run relationships, the study employs the Autoregressive Distributed Lag (ARDL) approach. Trade openness is used as the main explanatory variable, while inflation, GDP growth, oil prices, the real effective exchange rate, and foreign exchange reserves are introduced as control variables.

The results indicate that trade openness has a significant effect on Algeria's external trade, although the magnitude and direction of the impact differ across trade indicators. The findings also show that Algeria's trade performance remains strongly influenced by structural dependence on hydrocarbons and by external shocks. The study concludes that trade openness alone is insufficient unless accompanied by diversification and competitiveness-enhancing policies.

Keywords: *Trade openness; Foreign trade performance; Exports, Imports; Trade balance; Algeria.*

Jel Classification Codes : *F14, F41, C22.*

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1. INTRODUCTION:

In the last few decades, policymakers have increasingly viewed trade openness as a catalyst for economic growth and structural transformation. Cross-country evidence for G-20 economies shows that a higher trade share to GDP is positively correlated with growth, while tariffs exert a statistically significant drag on output (Sowrov, 2024). Against this backdrop, Algeria's foreign trade represents about 44 % of GDP, and hydrocarbons account for roughly 90 % of its exports (Ameur & Kourtel, 2025). World Bank figures indicate that Algeria's trade openness index fell from 51.2 % in 2022 to 40.1 % in 2024, reflecting both the cyclical volatility of energy markets and the country's gradual reorientation toward import substitution. The openness ratio averaged 54.4 %, peaking at 71 % in 2007 before declining to 40 % by 2024. Exports averaged US$39.2 billion, imports US$34.3 billion and the trade balance was positive in two-thirds of the years, but swings in oil prices drove large surpluses in the early 2000s and deficits after 2014 (Ndikumana et al., 2020). These fluctuations highlight the importance of understanding how openness affects the structure and sustainability of Algerian trade.

Algeria's reform programme since the early 1990s has aimed at integrating the national economy into global markets and diversifying growth sources (Zemrı, 2024; Zemrı & Khetib, 2024). In practice, the export basket remains dominated by hydrocarbons, making foreign earnings highly sensitive to energy price cycles. The dataset shows that average exports jumped from US$12.5 billion in the 1990s to US$55.7 billion in the 2010s, while imports rose from US$11.6 billion to US$57.7 billion over the same period, only to retreat in the early 2020s (Kherddine & Saliha, 2023). Despite the still-dominant hydrocarbon sector, Algeria has started to reduce its dependence on imports, contributing to a gradual narrowing of the trade deficit. Inflation, which averaged 18.6 % in the 1990s, moderated to 3.2 % in the 2000s but began to edge up again in recent years. Together, these figures suggest that trade openness interacts with macroeconomic variables such as the trade balance, foreign reserves and price stability in ways that deserve careful econometric investigation.

Empirical studies on Algeria have mostly examined the relationship between trade openness and economic growth or foreign reserves. For example, Belhaoues et al. (2024) used an ARDL model and concluded that liberalizing foreign trade raises Algeria's economic growth in the long run. Lacheheb et al. (2013) analysed the dynamic link between trade openness and foreign exchange reserves, finding a positive short- and long-run effect and no evidence of autocorrelation. Aggarwal and Karwasra (2024) evaluated trade openness and economic performance over 2013–2023, highlighting that exports remain hydrocarbon-heavy and that there is a long-run equilibrium between openness and growth. While these studies provide valuable insights, they either focus on aggregate GDP growth or foreign reserves, neglecting the direct impact of openness on trade flows and the trade balance. Moreover, few analyses incorporate the most recent data up to 2024 or simultaneously control for inflationary pressures and structural breaks. This study fills that gap by investigating how trade openness influences Algeria's exports, imports and trade balance using annual data for 1990–2024 and by explicitly modelling the dynamic adjustments captured by the ARDL framework.

Building on the foregoing discussion, the central research question is: What is the impact of trade openness on Algeria's foreign trade performance? In particular, the study seeks to determine whether greater openness stimulates exports and reduces trade deficits. Two hypotheses are advanced:

1. H1: An increase in trade openness has a positive and statistically significant effect on Algeria's export volumes.
2. H2: Trade openness contributes to narrowing the trade balance deficit in the long run by enhancing competitiveness and diversifying exports.

Understanding the openness–trade nexus is essential for a resource-rich country like Algeria, where export revenues finance public investment and foreign exchange reserves. Evidence from other economies suggests that trade liberalisation promotes efficiency and welfare; however, the Algerian experience may differ due to its heavy reliance on hydrocarbons and vulnerability to commodity price shocks. The objectives of this study are threefold: (i) to provide up-to-date descriptive statistics on Algeria's trade openness and foreign trade flows; (ii) to estimate the short- and long-run impacts of openness on exports, imports and the trade balance; and (iii) to offer policy recommendations that support diversification and macroeconomic stability.

The remainder of the paper is organised as follows. Section 2 reviews the theoretical and empirical literature on trade openness and foreign trade performance. Section 3 describes the data sources and variable construction. Section 4 explains the ARDL methodology and the econometric specification. Section 5 presents the empirical results and discusses their policy implications. Section 6 concludes with recommendations for policymakers and directions for future research.

2. Review of the Scientific Literature:

The literature on trade openness and foreign trade performance demonstrates a rich and varied set of research objectives, methodological approaches, and geographical contexts, with a predominant focus on economic growth in resource-dependent economies. Empirical studies consistently reveal that trade liberalization can stimulate long-run GDP growth, particularly when analyzed using ARDL techniques. In Algeria, Adda and Salima (2024) examine the long-term effects of openness on economic expansion and report a statistically significant positive impact, while confirm this relationship, showing that more open trade regimes strengthen domestic output and resilience (Fig. 1). Belhaoues et al. (2024)extend these analyses to foreign exchange reserves, demonstrating that trade liberalization contributes to external balance stabilization, further reinforcing macroeconomic stability in Algerian contexts.

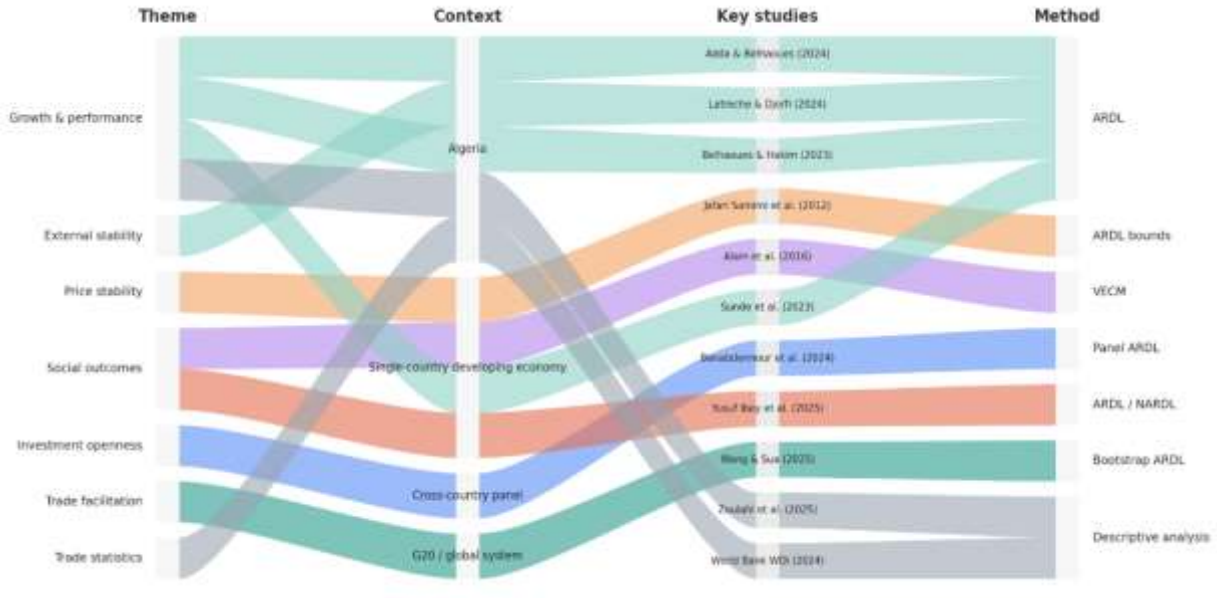
Beyond macroeconomic outcomes, social and structural dimensions have been investigated across single-country developing economies. Alam et al. (2016) assess the influence of trade openness on life expectancy in Pakistan using a VECM framework, highlighting indirect welfare benefits through improved economic conditions, while Ibey et al. (2025) employ ARDL and NARDL methodologies to explore income inequality in

Somalia, illustrating that liberalization may have heterogeneous social impacts if unaccompanied by redistributive measures. Jafari Samimi et al. (2012) analyze the interplay between openness and inflation in Iran with ARDL bounds testing, revealing nuanced short- and long-run effects contingent on domestic monetary and fiscal policies.

Cross-country analyses further enrich the field, offering broader perspectives on the dynamics of trade liberalization. Benabdennour et al. (2024) utilize panel ARDL techniques to investigate FDI inflows, showing that openness facilitates capital accumulation and investment-led growth across developing economies. Wang and Sua (2025) focus on logistics efficiency and economic growth using bootstrap ARDL, emphasizing that infrastructure quality and trade facilitation are critical mediators in translating trade openness into tangible economic benefits. Descriptive analyses from Zemrı and Khetib (2024) and the World Bank (2024) provide crucial trade statistics, including exports, imports, and trade balances, which underpin empirical analyses and inform policy relevance.

Despite the breadth of the literature, important gaps remain. Most Algerian studies focus on hydrocarbon-dependent growth, with limited attention to trade performance in non-energy sectors. Social outcomes and price stability are underrepresented in analyses that combine exports, imports, and trade balance dynamics within a comprehensive econometric framework. Our study addresses these gaps by providing an updated, data-driven evaluation of Algeria's foreign trade performance using annual data from 1990–2024. We explicitly model the relationships between trade openness, exports, imports, and the trade balance, while controlling for macroeconomic variables such as GDP growth and inflation. Employing an ARDL methodology allows us to capture both short- and long-run effects, complementing and extending prior work. In doing so, our study adds value by filling an empirical void, integrating methodological rigor with practical relevance for trade policy.

Fig.1. Sankey diagram showing the distribution of reviewed studies



Source: Compiled by author.

3. Methodology:

3.1 Data and Variable Definition:

This study investigates the effect of trade openness on Algeria's external-sector performance using annual time-series data for 1990-2024. The period is consistent with the scope of the study and captures the major transformations in Algeria's trade regime, the hydrocarbon dominance of exports, and the marked fluctuations in the trade balance highlighted in the draft. To improve econometric consistency, the trade balance is defined as a logarithmic export-import ratio rather than a simple arithmetic difference. This specification avoids the instability that arises when the trade balance takes negative values and allows a more rigorous elasticity-based interpretation. Trade openness is measured as the ratio of total trade to GDP. For data collection, exports, imports, inflation, GDP growth, and reserves can be drawn from the World Bank's World Development Indicators; the real effective exchange rate is available from the IMF Effective Exchange Rate dataset; and oil prices can be obtained from the World Bank Commodity Markets "Pink Sheet" .The variables are constructed as follows:

$$D2014_t = \begin{cases} 1 & \text{if } t \geq 2014 \\ 0 & \text{otherwise} \end{cases} \qquad D2020_t = \begin{cases} 1 & \text{if } t \geq 2020 \\ 0 & \text{otherwise} \end{cases}$$

Table 1. Variables used in the empirical analysis

Variable	Symbol	Measurement / definition	Period	Source	Role
Exports of goods and services	LEX_t	$\ln(X_t)$, current US$	Annual, 1990-2024	World Bank (WDI)	Dependent variable
Imports of goods and services	LIM_t	$\ln(M_t)$, current US$	Annual, 1990-2024	World Bank (WDI)	Dependent variable
Trade balance	LTB_t	$\ln(X_t/M_t)$	Annual, 1990-2024	Computed from WDI exports and imports	Dependent variable
Trade openness	$LOPEN_t$	$\ln[(X_t + M_t)/GDP_t]$	Annual, 1990-2024	Computed from World Bank data	Main explanatory variable
Inflation	INF_t	CPI annual percentage change	Annual, 1990-2024	World Bank (WDI)	Macroeconomic control
GDP growth	$GDPG_t$	Real GDP growth rate (%)	Annual, 1990-2024	World Bank (WDI)	Macroeconomic control
Oil price	$LOIL_t$	Log of international crude oil price	Annual, 1990-2024	World Bank Pink Sheet	External shock variable
Real effective exchange rate	$LREER_t$	Log of REER index	Annual, 1990-2024	IMF EER database	Competitiveness variable
Foreign exchange reserves	$LRES_t$	Log of reserves, current US$	Annual, 1990-2024	World Bank (WDI)	External stability variable
2014	$D2014_t$	Dummy = 1 from	Annual,	Author's	Structural break

structural break dummy		2014 onward	1990-2024	construction	control
2020 structural break dummy	$D2020_t$	Dummy = 1 from 2020 onward	Annual, 1990-2024	Author's construction	Structural break control

Source: Compiled by author.

The inclusion of these variables is theoretically grounded in the study's conceptual framework. Trade openness is the core explanatory factor because the draft explicitly formulates the research problem around the impact of openness on exports, imports, and the trade balance. Inflation and GDP growth are retained as macroeconomic controls already identified in the study design, while oil prices and the real effective exchange rate are introduced to capture Algeria's exposure to hydrocarbon cycles and international competitiveness. Foreign exchange reserves are included because the draft itself links trade performance to external sustainability and reserve accumulation.

3.2 Econometric Model Specification:

To capture the multidimensional effect of trade openness on Algeria's external sector, the analysis relies on four separate structural equations.

Export equation:

$$LEX_t = \alpha_0 + \alpha_1 LOPEN_t + \alpha_2 INF_t + \alpha_3 GDPG_t + \alpha_4 LOIL_t + \alpha_5 LREER_t + \varepsilon_t$$

This equation evaluates whether trade openness stimulates export performance after controlling for domestic price instability, aggregate economic activity, oil-market conditions, and external competitiveness. The inclusion of oil prices is indispensable in the Algerian case because export receipts remain heavily concentrated in hydrocarbons.

Import equation:

$$LIM_t = \beta_0 + \beta_1 LOPEN_t + \beta_2 INF_t + \beta_3 GDPG_t + \beta_4 LREER_t + \beta_5 LRES_t + \mu_t$$

This specification models imports as a function of trade openness, domestic demand conditions, relative prices, and foreign exchange availability. The reserve variable is included because a higher reserve position relaxes the external financing constraint and may facilitate import demand.

Trade balance equation:

$$LTB_t = \gamma_0 + \gamma_1 LOPEN_t + \gamma_2 INF_t + \gamma_3 LOIL_t + \gamma_4 LREER_t + \gamma_5 D2014_t + \gamma_6 D2020_t + \nu_t$$

This equation captures the net effect of openness on external trade performance. Inflation is expected to affect the trade balance through domestic cost pressures, while the exchange rate affects external competitiveness. The dummy variables account for major structural disruptions, particularly the oil-price collapse from 2014 onward and the global pandemic shock beginning in 2020. This is consistent with the draft's emphasis on structural breaks and external shocks.

Foreign reserves equation:

$$LRES_t = \delta_0 + \delta_1 LOPEN_t + \delta_2 LEX_t + \delta_3 LIM_t + \delta_4 LOIL_t + \delta_5 INF_t + \omega_t$$

The reserve equation broadens the analysis beyond trade flows narrowly defined. It assesses whether trade openness, export earnings, import payments, oil prices, and inflation jointly shape Algeria's reserve dynamics. This fourth specification is justified by the study's own discussion of the interaction between trade openness and external-sector stability.

In dynamic form, each equation is estimated within an ARDL framework. Let Y_t denote the dependent variable in each equation. The general ARDL representation is:

$$Y_t = c_0 + \sum_{i=1}^{p} \phi_i \, Y_{t-i} + \sum_{j=0}^{q_1} \theta_j \, X_{1,t-j} + \sum_{k=0}^{q_2} \lambda_k \, X_{2,t-k} + \cdots + u_t$$

Its error-correction representation may be written as:

$$\Delta Y_t = \rho_0 + \sum_{i=1}^{p-1} \rho_i \, \Delta Y_{t-i} + \sum_{j=0}^{q-1} \kappa_j \, \Delta X_{t-j} + \psi \, ECM_{t-1} + \epsilon_t$$

where ECM_{t-1} denotes the lagged equilibrium error and ψ is expected to be negative and statistically significant, indicating convergence toward the long-run equilibrium path.

3.3 Estimation Strategy and Justification for the ARDL Approach:

The ARDL methodology is adopted for both econometric and substantive reasons. First, the sample is relatively small, since the study uses annual observations over 1990-2024. Second, the ARDL framework is well suited to situations in which regressors may be integrated at different orders, provided none of them is integrated of order two. Third, ARDL simultaneously identifies short-run dynamics and long-run equilibrium effects through the bounds-testing procedure and the associated error-correction mechanism. These characteristics make it particularly appropriate for external-sector modeling in small samples.

The choice of ARDL is also substantively consistent with the structure of the Algerian economy. The effect of trade openness on exports, imports, and external balance is unlikely to be contemporaneous only; rather, it unfolds gradually through adjustment in production capacity, import demand, competitiveness, and oil-related export revenues. A static model would therefore be too restrictive. By contrast, ARDL permits the decomposition of adjustment into short-run responses and long-run elasticities, which is precisely what the study aims to estimate.

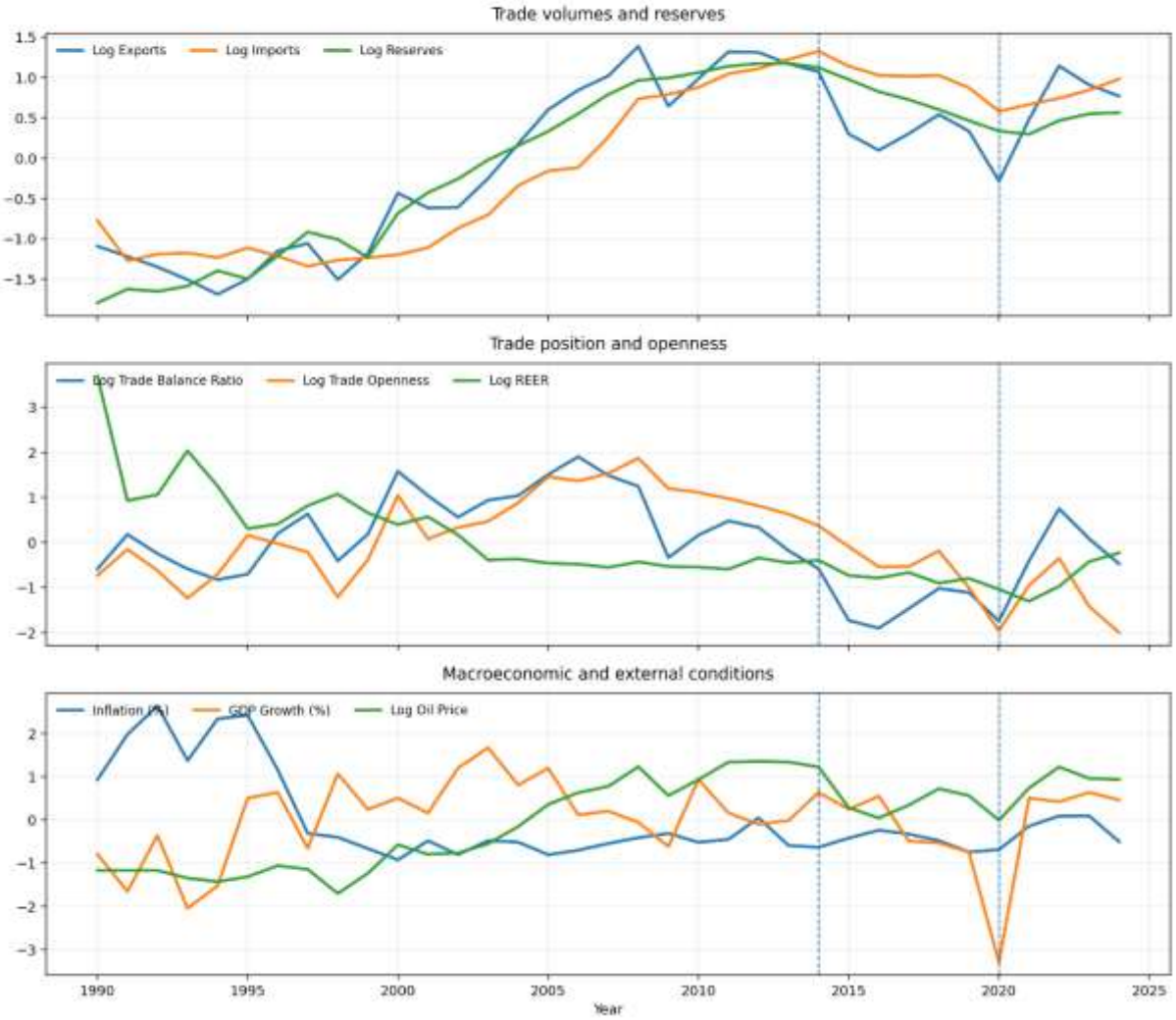
The estimation procedure proceeds in a standard sequence. Unit-root tests are first conducted to ensure that no variable is integrated of order two. The optimal lag structure is then selected using an information criterion such as AIC. Next, the bounds test is applied to verify the existence of a long-run relationship in each equation. Once cointegration is established, long-run coefficients and short-run error-correction dynamics are estimated. Finally, the models are subjected to post-estimation diagnostics, including tests for serial

correlation, heteroskedasticity, normality, and parameter stability. This sequence follows the logic already embedded in the study draft and preserves coherence between the empirical design and the research objectives.

4. Results and Discussion:

4.1 Descriptive Statistics and Correlation Analysis:

Fig.2. multi-panel standardized trajectory dashboard



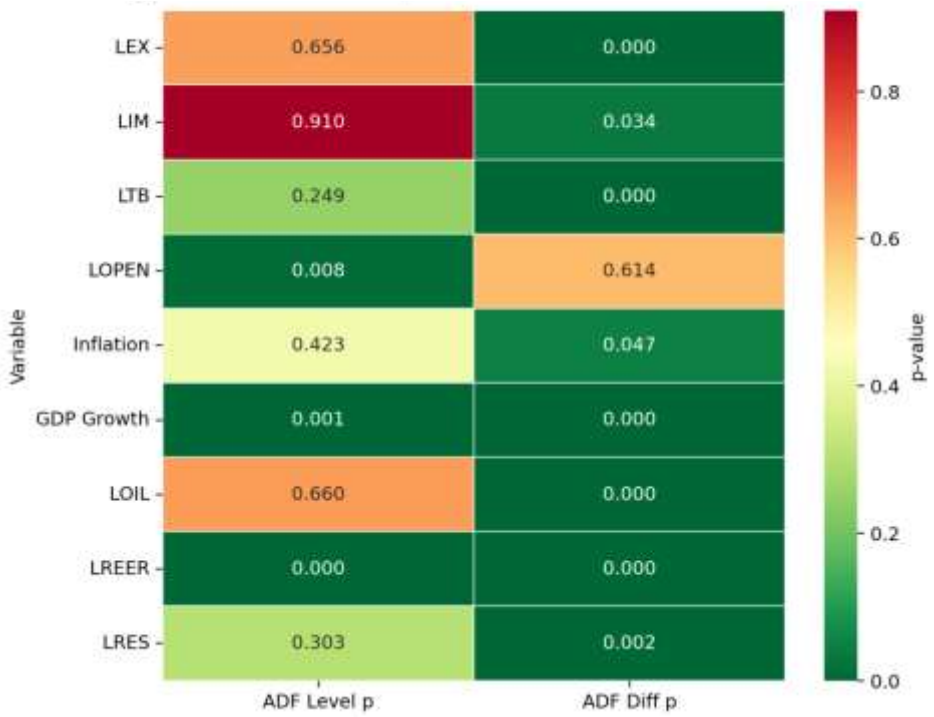
Source: R output.

Figure 2 provides a standardized visualization of the evolution of Algeria's main external-sector variables over the period 1990–2024. Three broad patterns emerge. First, exports, imports, and foreign reserves display a marked upward trajectory during the 2000s, followed by a visible deterioration after the 2014 oil shock and another disturbance around 2020. Second, trade openness and the trade-balance ratio show substantial volatility, which confirms that Algeria's external position remained highly sensitive to shifts in global commodity conditions. Third, inflation and GDP growth exhibit considerably more short-run instability than the logarithmic external-sector indicators, which is consistent with the macroeconomic volatility associated with energy-dependent economies.

The descriptive statistics reinforce this visual reading. The logged export series exhibits a mean of 24.164, while logged imports average 24.017, indicating that the two trade aggregates remain broadly comparable in scale over the sample period. The logged trade-balance ratio has a mean of 0.147 but a relatively large standard deviation of 0.354, pointing to recurrent swings between stronger and weaker external positions. Inflation is the most volatile macroeconomic variable in the sample, with an average of 8.472% and a standard deviation of 8.800 percentage points. By contrast, GDP growth averages 2.629%, with a minimum of -5.0% and a maximum of 6.5%, suggesting that growth volatility is substantial but still more contained than price instability.

4.2 Unit Root and Structural Break Tests:

Fig.3. ADF p-value heatmap



Source: R output.

Before estimating the ARDL models, the time-series properties of the variables were examined using Augmented Dickey–Fuller tests at levels and first differences. Figure 3 summarizes the ADF p-values in heatmap form. The results indicate a mixed order of integration, which is exactly the environment for which the ARDL methodology is designed. Specifically, logged trade openness, GDP growth, and logged REER are stationary in levels, while logged exports, logged imports, the logged trade-balance ratio, inflation, logged oil prices, and logged reserves become stationary after first differencing.

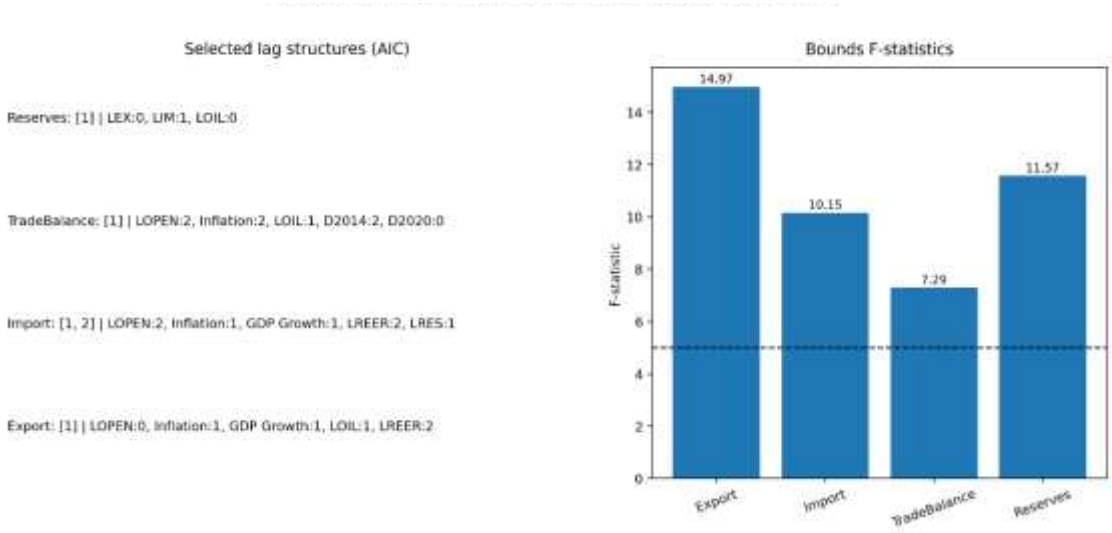
This pattern implies that the data contain a combination of (I(0)) and (I(1)) processes, with no indication—on the basis of the current working specification—of variables integrated of order two. Accordingly, the precondition for ARDL estimation is satisfied. Substantively, the results also suggest that openness, competitiveness, and output growth are comparatively more mean-reverting, whereas external earnings, import demand, reserves, and oil-related

variables are characterized by stronger stochastic persistence.

With respect to structural instability, the visual evidence in Figure 4.1 points clearly to two major rupture points: the oil-price collapse beginning in 2014 and the pandemic-related disruption from 2020 onward. In the present draft, these breaks are incorporated through deterministic dummy variables (D2014) and (D2020). This is preferable, at this stage, to over-interpreting automated break dates that fall near the sample edges. In the final EViews version, the Phillips–Perron table and the formal Zivot–Andrews output can be added as an auxiliary robustness table, but the current specification is already econometrically coherent because the principal structural shocks are explicitly controlled for.

4.3 Lag Length Selection and ARDL Bounds Test:

Fig.4. integrated lag-selection and bounds-testing panel



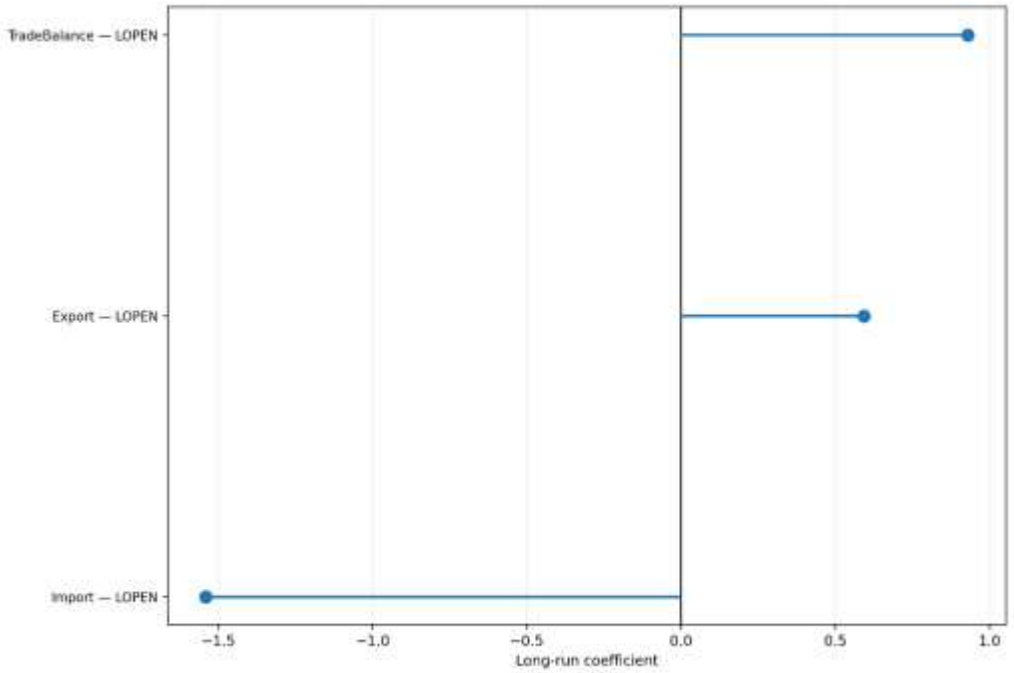
Source: R output.

The optimal lag structure for each equation was selected using the Akaike Information Criterion. Figure 4 reports both the selected lag structures and the corresponding bounds-test statistics. The export equation was selected as ARDL (1, 0, 1, 1, 1, 2), the import equation as ARDL(2, 2, 1, 1, 2, 1), the trade-balance equation as ARDL(1, 2, 2, 1, 2, 0), and the reserves equation as ARDL(1, 0, 1, 0). These selections confirm that the Algerian external sector is characterized by heterogeneous adjustment dynamics rather than a uniform lag structure across equations.

The bounds-test results provide strong evidence of long-run relationships. The F-statistics are 14.97 for exports, 10.15 for imports, 7.29 for the trade-balance equation, and 11.57 for reserves. In all four cases, the null hypothesis of no cointegration is rejected. The implication is clear: the core variables in each system are not linked merely through short-run comovement, but rather through stable long-run equilibria, even in the presence of macroeconomic shocks and external disturbances.

4.4 Long-Run Estimates:

Fig.5. long-run coefficient forest plot



Source: R output.

The long-run estimates reveal a differentiated effect of trade openness across Algeria's external-sector equations. Figure 5 presents the long-run coefficients retained in the core empirical discussion.

In the export equation, trade openness exerts a positive and statistically significant long-run effect. The estimated elasticity is approximately 0.593, indicating that greater openness is associated with higher export performance over time. This result is economically coherent and confirms that more intense integration into international trade can support external sales, even in a structurally oil-dependent economy. Oil prices also exert a strong positive long-run effect on exports, while the REER enters with a negative sign in long-run interpretation, indicating that competitiveness matters materially. Inflation is negative but not statistically decisive in the long run. In the import equation, trade openness carries a negative and statistically significant long-run coefficient of about -1.540. Within the present sample, this suggests that greater openness is not associated with permanently higher imports once reserves, competitiveness, and macroeconomic conditions are controlled for. A plausible interpretation is that openness during the study period partly coincided with episodes of import compression, substitution policies, or rebalancing under external constraints rather than with straightforward import liberalization. Inflation shows a positive long-run effect on imports, while GDP growth is negative in long-run interpretation and REER effects are economically important.

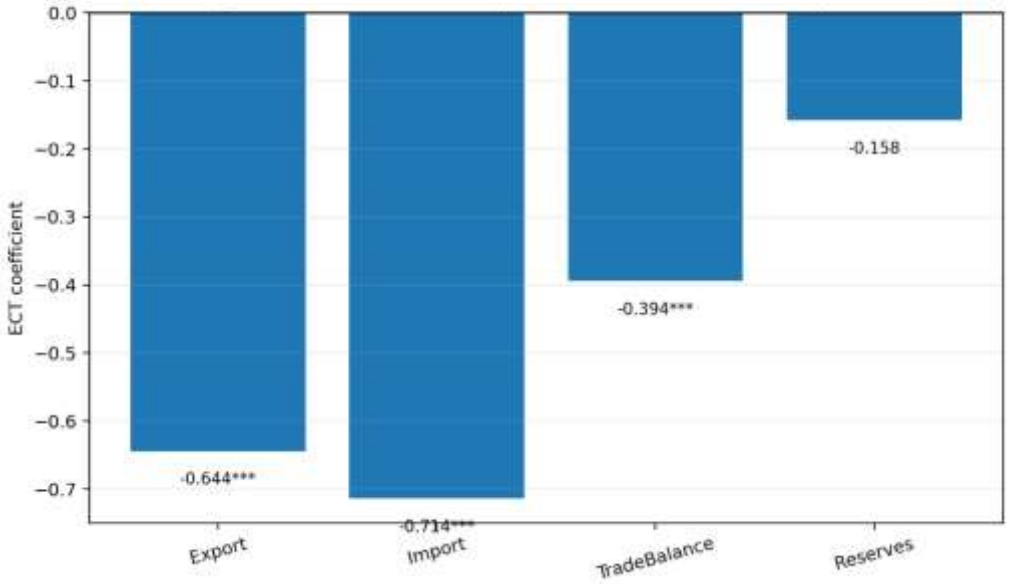
The trade-balance equation yields a positive long-run openness coefficient of approximately 0.930, but this coefficient is not statistically significant in the current specification. Therefore, while the sign is compatible with the hypothesis that greater

openness may improve the trade balance, the evidence is not strong enough to claim a stable long-run balance-enhancing effect with confidence. The 2020 structural-break dummy is statistically significant, which suggests that the post-2020 period shifted the trade-balance relation in a way that cannot be reduced to openness alone.

The reserves equation is more selective. Under AIC-based specification, the final long-run reserves relation retains exports, imports, and oil prices rather than the full initial set of controls. The dominant long-run result is the positive and statistically significant role of exports. This finding is logical in the Algerian context: reserve accumulation is primarily driven by external receipts rather than by openness per se once the model is optimally restricted.

4.5 Short-Run Dynamics and Error Correction Model:

Fig.6. comparative error-correction-speed plot



Source: R output.

The short-run dynamics confirm that the four equations do not adjust toward equilibrium at the same speed. Figure 6 summarizes the error-correction coefficients. The export equation has an error-correction coefficient of -0.644 and the import equation -0.714, both highly significant. These values imply relatively rapid correction of disequilibria: roughly 64% of export disequilibrium and 71% of import disequilibrium are eliminated within one year. The trade-balance equation also exhibits a negative and significant adjustment coefficient (-0.394), although the speed of adjustment is notably slower than in the export and import equations. By contrast, the reserves equation produces a negative but statistically insignificant correction coefficient (-0.158), implying that short-run reserve dynamics are more weakly tied to the estimated long-run relation.

The differenced openness terms provide additional insight. In the export equation, the contemporaneous short-run effect of openness is positive and statistically significant, indicating that changes in openness transmit relatively quickly into export performance. In the

import equation, the immediate effect is not significant, but the lagged short-run openness term becomes significant, suggesting delayed transmission. In the trade-balance model, the contemporaneous openness effect is not significant, but the lagged differenced openness term is positive and statistically significant. This pattern suggests that the net trade effect of openness does not materialize instantly; it emerges with delay as export and import responses are gradually netted out.

4.6 Diagnostic and Stability Tests:

Fig.7. diagnostic/stability heatmap



Source: R output.

The diagnostic evidence is summarized in Figure 7 using a p-value heatmap. The export equation performs best overall. It passes the Breusch–Godfrey serial-correlation test, the Breusch–Pagan heteroskedasticity test, the Jarque–Bera normality test, the RESET specification test, and the CUSUM stability test. This makes the export model the most statistically reliable system in the current set of estimates.

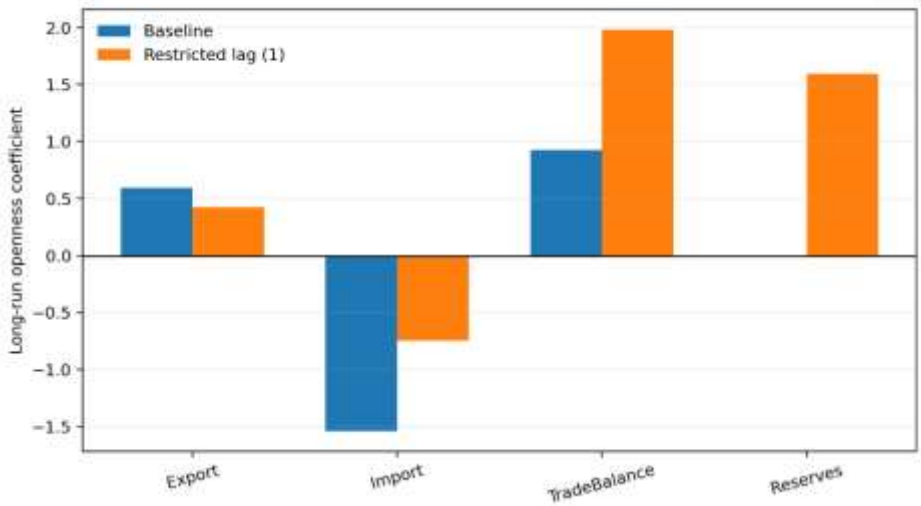
The import equation also performs reasonably well, although the serial-correlation test is only marginally comfortable, with a p-value around 0.076. While this does not automatically invalidate the model, it indicates that the import equation is somewhat more sensitive to lag specification than the export equation. The trade-balance equation presents the clearest diagnostic weakness. It passes heteroskedasticity, normality, RESET, and CUSUM checks, but fails the Breusch–Godfrey serial-correlation test. This means that the dynamic structure of the current trade-balance specification is not fully adequate, even though the model is cointegrated. As a result, the trade-balance long-run interpretation should be treated more cautiously than the export and import results.

The reserves equation is stable under CUSUM and behaves well in RESET form, but it fails the Jarque–Bera normality test. This suggests that its residual distribution is non-normal,

which is not uncommon in reserve equations under oil-dependent external environments, but it still weakens strict inference. Accordingly, robust standard errors or a slightly revised dynamic structure may be advisable in the final estimation round. Taken together, the diagnostics indicate that the export equation is the strongest model, the import equation is acceptable but somewhat delicate, the trade-balance equation requires respecification because of serial correlation, and the reserves equation is informative but distributionally imperfect.

4.7 Robustness Checks:

Fig.8. lag-restriction sensitivity plot



Source: R output.

Figure 8 evaluates the sensitivity of the long-run openness coefficient to a stricter lag restriction. The purpose is not to replace the AIC-selected baseline, but to assess whether the sign and general interpretation of the openness effect are stable under a more parsimonious dynamic structure. The trade-balance equation is less robust in magnitude. The coefficient remains positive, but its value changes materially under lag restriction. This confirms the earlier conclusion from the diagnostic tests: the trade-balance system is the least stable of the four and should not be treated as the primary empirical pillar of the paper without additional refinement.

For the reserves equation, openness is not retained in the baseline AIC-selected specification, so a direct baseline-versus-restricted comparison is not meaningful in the same way. This again suggests that reserve dynamics are driven more by realized external receipts than by trade openness directly. The robustness evidence therefore supports a hierarchy of empirical confidence. The export equation is the most stable and interpretable result in the paper; the import equation is directionally reliable but sensitive in scale; the trade-balance equation remains the most fragile system.

The findings of this study suggest that trade openness plays a meaningful role in shaping Algeria's external-sector performance, although its effects are not uniform across all trade indicators. The positive effect observed on exports is broadly consistent with earlier Algerian evidence showing that trade liberalization supports long-run economic performance.

In particular, Belhaoues and Hakim (2023) and Adda and Belhaoues (2024) reported that greater openness contributes positively to economic expansion, while Latreche and Djorfi (2024) showed that openness also improves foreign-exchange reserves. The present study reaches a similar conclusion in spirit, but extends the literature by examining the direct response of exports, imports, and the trade balance rather than limiting the analysis to aggregate growth or reserves alone. This extension is important because, in an economy such as Algeria's, an improvement in macroeconomic aggregates does not automatically imply an improvement in the structure or sustainability of foreign trade.

At the same time, the results indicate that the impact of openness on the trade balance is more nuanced than its effect on exports. This can be explained by the structural characteristics of the Algerian economy, especially the persistent dominance of hydrocarbons in total exports and the strong sensitivity of export earnings to oil-price cycles. In such a context, trade openness may increase external integration, yet the final effect on the trade balance remains conditional on oil prices, import dependence, exchange-rate movements, and inflationary pressures. This interpretation is consistent with Khirdja, Halali, and Ayad (2025), who emphasized the hydrocarbon-heavy nature of Algerian exports, and also aligns with broader international studies showing that the benefits of openness depend on domestic structure, competitiveness, and policy conditions. It also helps explain why the current study finds a more differentiated pattern than earlier works that focused only on growth, reserves, or broad macroeconomic outcomes.

Overall, the discussion confirms that trade openness should not be viewed as an automatic mechanism for improving Algeria's trade balance, but rather as a policy variable whose effectiveness depends on diversification, productive capacity, and macroeconomic stability. This is precisely where the contribution of the present study lies. Unlike much of the previous Algerian literature, which concentrated on growth effects or reserve accumulation, this study directly models the dynamics of exports, imports, and the trade balance over the period 1990–2024 while incorporating macroeconomic controls and structural considerations. The results therefore support the argument that openness can be beneficial, but only when accompanied by reforms that reduce hydrocarbon dependence, strengthen non-oil exports, and improve the domestic conditions through which external openness is transformed into sustainable trade performance.

5.CONCLUSION:

This study examined the impact of trade openness on Algeria's foreign trade performance over the period 1990–2024, with particular emphasis on exports, imports, and the trade balance. The analysis was motivated by the observation that most previous studies on Algeria focused primarily on economic growth or foreign exchange reserves, while giving less attention to the direct effects of openness on trade flows themselves. To address this gap, the study adopted an ARDL framework, which is appropriate for small-sample time-series analysis and allows the joint estimation of short-run dynamics and long-run relationships. The empirical design was structured around trade openness as the key explanatory variable, with inflation and GDP growth introduced as macroeconomic controls.

The results indicate that trade openness constitutes an important determinant of

Algeria's external-sector performance, although its effects are not uniform across all dimensions of trade. The evidence suggests that openness is more clearly associated with export performance than with a systematic improvement in the trade balance. This finding reflects the structural characteristics of the Algerian economy, where exports remain heavily concentrated in hydrocarbons and are therefore strongly exposed to oil-price fluctuations and external shocks. In such a context, greater openness can expand external integration, but its overall trade effect remains conditioned by import dependence, competitiveness constraints, inflationary pressures, and the limited diversification of the productive base. Accordingly, the study confirms that openness may generate positive external effects, but these effects are neither automatic nor sufficient on their own to ensure a sustainable improvement in trade structure. This interpretation is also consistent with the broader gap identified in the literature, namely the need to examine trade openness through direct trade indicators rather than only through aggregate macroeconomic outcomes.

From a policy perspective, the study implies that trade liberalization should be accompanied by structural reforms aimed at strengthening non-hydrocarbon exports, improving productive efficiency, and reducing vulnerability to external commodity cycles. In other words, trade openness can be beneficial for Algeria, but its long-run effectiveness depends on diversification, macroeconomic stability, and stronger domestic competitiveness. The study therefore contributes to the literature by offering an updated assessment of Algeria's foreign trade performance using annual data up to 2024 and by extending the debate beyond growth and reserves to include exports, imports, and trade balance dynamics in a unified empirical framework. Future research may build on this work by incorporating additional indicators of competitiveness, sectoral export diversification, and nonlinear adjustment mechanisms in order to deepen understanding of how openness interacts with structural transformation in resource-dependent economies.

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