Assessing the Role of FDI in Promoting Sustainable Economic Growth: An Empirical Study - Case of Algeria

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Abstract:

This study examines the impact of Foreign Direct Investment (FDI) on economic growth in Algeria over the period 1990–2023 using the Autoregressive Distributed Lag (ARDL) cointegration framework. Annual data from the World Bank were employed to analyze the long- and short-run dynamics between GDP growth and five macroeconomic determinants: FDI inflows, gross fixed capital formation (GFCF), inflation (INF), the official exchange rate (LEX), and trade openness (TR).

The empirical results show that FDI exerts a negative and statistically insignificant long-run effect on economic growth, suggesting a crowding-out phenomenon largely driven by the dominance of hydrocarbon-based investment and weak technological spillovers. In contrast, domestic investment (GFCF) demonstrates a strong positive short-run impact on growth, although this effect dissipates over time. Inflation exhibits a significant negative medium-term effect, whereas exchange rate depreciation enhances growth initially but becomes harmful in later periods due to imported inflation. Trade openness is found to be insignificant across all horizons, reflecting Algeria's reliance on oil exports.

Keywords: FDI; Economic Growth; Openness; ARDL; Algeria.

Jel Classification Codes: F21, O47 , F23, C51, O55.

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1. INTRODUCTION

Nowadays, foreign investment is considered a main driver of economic expansion. According to the Washington Consensus, major contributors such as the United States (US), the International Monetary Fund (IMF), and the World Bank noted that luring foreign direct investment (FDI) is typically at the top of most nations' economic policy agendas. FDI is currently rising even faster than international trade, which has been the main mechanism connecting national economies, according to the World Investment Report. Even countries previously resistant to foreign investment, such as China, have opened their markets to foreign money after realizing the economic advantages of doing so. Both industrialized and developing nations compete to draw foreign direct investment.

FDI Report 2024 of Financial Times Limited indicates that global FDI projects grew by 1.1% in 2024, accelerating from the 4.9% increase recorded in 2023. In total, FDI Markets tracked 16,427 investment projects worldwide in 2024. Following an 8.2% contraction in 2023, capital expenditures linked to FDI projects rebounded by 7.1% in 2024 to reach $1.33 trillion, signaling renewed confidence in capital-intensive industries. A similar recovery was observed in job creation, with FDI-generated employment growing 5.3% to 3.85 million new jobs in 2024, after a 2.8% reduction in the previous year (Jacopo, 2024, pp. 3 - 7).

In spite of the fact that Algeria positions as Africa’s third-largest oil and gas maker, it proceeds to confront note worthy challenges in pulling in maintain edremote coordinate venture (FDI) past the hydrocarbon division.

The Algeria’s economy has generally depended exceptionally intensely on oil and gas generation which persistently secured. Over 90% of the Send out Incomes. This heavy dependence makes the Algerian economy highly Susceptible to price volatility and external shocks, but moreover, significantly diminishes the country's capability to form more extensive work openings that may back the country's labor constrain and bring within the exceptionally much required administration know how and progressed innovations. All off which may enhance the Algerian economy's development and advancement and given with a more adjusted and broaden edin come base to realize that our current government will need a set of devices, the fore most critical of which is irrefutably outside coordinat eventure.

FDI is universally recognized as a basic catalyst for financial advancement, especially in rising economies. Whereas, Algeria has solid potential as a goal for maintainable FDI inflows, the Algerian economy has remained for the biggest period unattractive to most foreign investors due to the presence of numeroussim pediments determined from defensive administrative approaches need of created and solid framework for bigger speculations and the deficiency in prepared and qualified labor force for particular innovation related ventures as it were increasing investment costs and risks through and through.

This situation has left the economy lacking essential capital exchange and work rate, moreover, the true insights behind the current FDI influx and the effect of later a long-time approach change to draw inmodern FDI activities remained generally scholastically unmeasured or organized.

2. Theoretical Framework:

Contemporary economic literature demonstrates a multifaceted relationship between foreign direct investment (FDI) and economic growth, with recent studies emphasizing the critical role of digital transformation, environmental sustainability, and institutional quality. The theoretical foundation builds on endogenous growth theory, which posits that FDI contributes to growth through technology transfer, human capital development, and productivity enhancements (Romer,P.M, 1990).

Recent empirical studies have significantly advanced our understanding of this relationship, (Nistor, 2014)demonstrates that FDI has a beneficial impact on economic growth. Increases in FDI boost export activity, encourage the flow of products and services, or provide access to technology, all of which raise GDP. Furthermore, because TFP measures the effectiveness of the people and capital resources utilized in production, it also has a favorable effect on economic growth. Businesses will depend on TFP to boost their production capacity and GDP, and it will also help enhance the outcomes of production activities and input-output, both of which are critical to the economy (Arazmuradov, Gianmaria, & Scotti, 2014). Thus, economic growth theories anticipate that TFP and FDI will have a favorable effect on GDP growth.

According to certain earlier research, FDI boosts economic expansion. According to(Sokang, 2018), FDI has a favorable effect on economic growth since it enables local enterprises to obtain more sophisticated technologies and expand production. Additionally, FDI increases capital efficiency, boosts export output, supplements capital, and generates a sizable budget to support economic growth(Agrawal & Aamir Khan, 2011). Nonetheless, some research indicates that FDI and economic growth are negatively correlated. A shortage of domestic investment capital and challenges using domestic capital and human resources result from an increase in FDI projects, which triggers an economic downturn(Almfraji & Almsafir, 2014).

In the opinion of(Sabir, Anum, & Abbas, 2019), FDI may result in trade imbalances. Employment will decline and fewer items will be created when imports exceed exports, potentially leading to a trade deficit. Prior research has demonstrated both positive and negative consequences of the link between foreign direct investment and economic growth. Using data samples from middle-income nations like China, India, and Cambodia, studies demonstrate a favorable correlation between foreign direct investment (FDI) and economic growth(Sokang, 2018)(Agrawal & Aamir Khan, 2011). Although some studies have used data samples from middle-income nations like Bolivia, Brazil, Colombia, and Ecuador, the overall conclusion is that foreign direct investment (FDI) hinders economic growth (Almfraji & Almsafir, 2014)(Sabir, Anum, & Abbas, 2019).

The research by (Chaplyuk, Akhmedov, Zeitoun, Abueva, & Al Humssi, 2022)analyzed how foreign direct investment affects Algeria's economic development. The research shows that foreign direct investment has positively affected Algeria's economic growth but its effects remain restricted because the country depends heavily on hydrocarbon sectors. The research indicates that FDI inflows have mainly increased capital stock in the energy sector yet they have not led to meaningful technological transfers or development of alternative productive sectors. The sectoral concentration together with bureaucratic hurdles and unfavorable

business climate restricts FDI from achieving sustainable economic growth in Algeria(Chaplyuk V. D., 2022).

(Iamsiraroj, Sasi & Ulubaşoğlu, Mehmet Ali, 2015)conducted a comprehensive meta-analysis that analyzed 880 estimates from 108 studies to determine FDI has a positive and significant impact on economic growth which depends on host countries' absorption capacity including trade and financial openness (World Economy).(Iamsiraroj, 2016) demonstrated economic integration's importance for FDI-growth relationships through his analysis of 124 countries from 1971 to 2010 which revealed robust evidence of mutual influence (World Development).

(Belloumi & Alshehry, A, 2018)used the ARDL limits testing methodology (Economies) to show that foreign direct investment had a significant impact on Saudi Arabia's non-oil economic growth.(Wang, Xinxin, Xu, Zeshui, Qin, Yong, & Skare, Marinko, 2022)conducted a bibliometric analysis of 1,075 publications indexed in Scopus, which showed that FDI-growth research is a dynamic domain with evolving theoretical and methodological frameworks (Croatian Operational Research Review).

Empirical research has expanded its investigation of the intricate relationship between foreign direct investment (FDI) and economic growth in Algeria and other economies with comparable macroeconomic conditions and policy systems. The state-driven development model combined with natural resource dependence makes Algeria a primary subject for such research. (Udemba & Yalçıntaş, 2021)used a nonlinear autoregressive distributed lag (NARDL) model to analyze FDI-natural resources-environmental performance relationships in Algeria through data from 1970 to 2018. The research demonstrated that positive FDI inflows generated economic growth and simultaneously enhanced environmental results which supported the pollution-halo hypothesis (Resources Policy).

On the other hand,(Mahfoudi, Riache, & Louail, 2024)analyzed FDI's impact on GDP growth in Algeria and Saudi Arabia through their comparison of both countries from 1970 to 2021. The authors emphasized that economic diversification represents an essential requirement to maintain these positive outcomes (Economics and Environment). The study employing ARDL bounds testing for Algeria during 1980–2020 established that trade openness consistently boosted growth but FDI produced limited long-term effects unless the investment climate underwent structural improvements. These studies jointly show that foreign direct investment (FDI) can stimulate economic growth but its effectiveness depends on the country-specific conditions and regulatory frameworks.

Besides that,(Messaoudi, Derbal, & Benhaddou, 2022)studied the effects of foreign direct investment on macroeconomic indicators in Algeria from 1990 to 2020. The research evaluated the connection between FDI inflows and essential economic indicators which showed that foreign direct investment positively affects economic growth in Algeria from 1990 to 2020. The inflation rates negatively affected economic growth in Algeria throughout the same time period.

Although,(Hallci & Meddahi , 2025)study the impact of foreign direct investment (FDI) on economic growth in Algeria during the period between 1990 and 2020. To achieve this objective, the researchers employed the simultaneous integration method, utilizing several variables based on empirical studies. The results of this study indicated that foreign direct

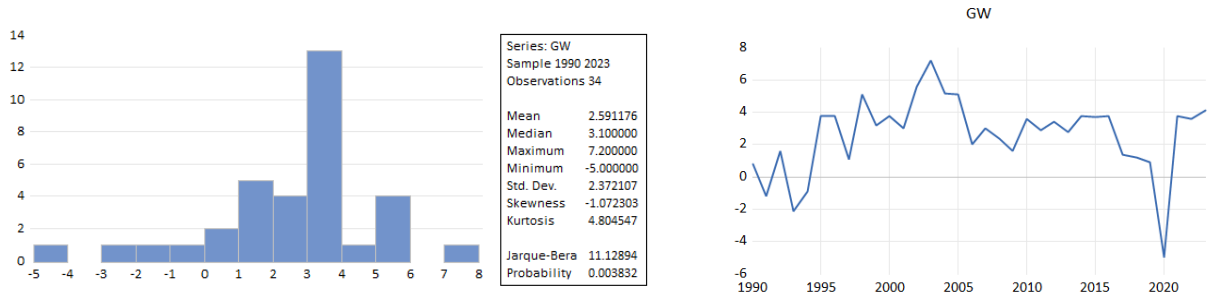
investment has a negative impact on economic growth in Algeria. This is attributed to its concentration in the hydrocarbons sector while the significance of other productive sectors is almost negligible.

3. Descriptive Analysis & Results:

In this section, we will present a descriptive analysis of the study variables over the period 1990-2020. This step will assist in understanding the evolution of the data during the study period. It will also enable us to assess the homogeneity of their levels by examining the maximum and minimum values, the mean and the standard deviation.

3.1 Descriptive of Growth (GW):

Fig.1: Histogram and Graph of EconomicGrowth 1990-2023

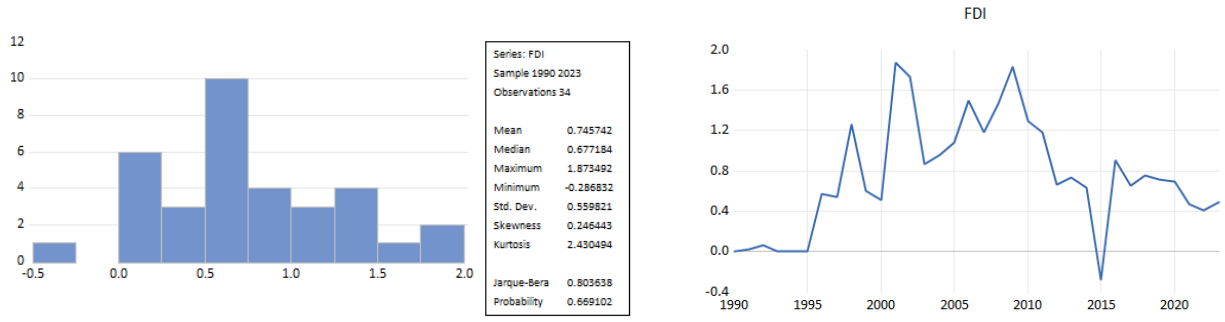


Source:Prepared by authorusing EViews 12 Software

The results confirm that the series exhibits station arity, as the P-value (probability< 0.05) indicates. The series fluctuates around a constant mean and variance over time. The maximum growth rate was recorded at 7.2% in 2003, while the minimum value was -5% in 2020. The mean value of the series was 2.59%, and the dispersion measured by the standard deviation was estimated at 2.37.

3.2 Descriptive of Foreign Direct Investment (FDI):

Fig.2:Histogram and Graph of Foreign Direct Investment 1990-2023



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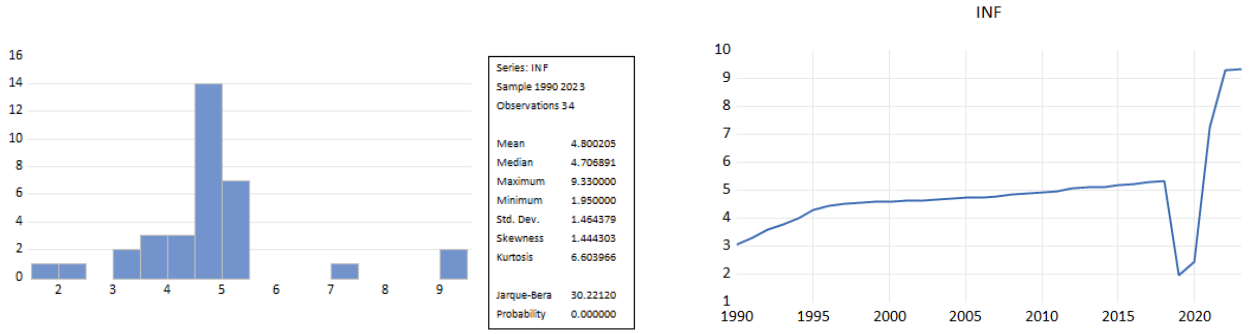
It isevidentthat the seriesis**not stationary**, as the P-value (probability>0.05) indicates. The seriesdoes not fluctuatearound a constant mean and variance over time, suggesting the presence of a unit root. The maximum growth rate was recorded at 1.873% in 2001, while the

minimum value was -0.286% in 2015. The mean value of the serieswas 0.7457%, and the dispersion measured by the standard deviation was estimated at 0.56.

3.3 Descriptive of Inflation (INF):

Fig.3:Histogram and Graph of Inflation 1990-2023



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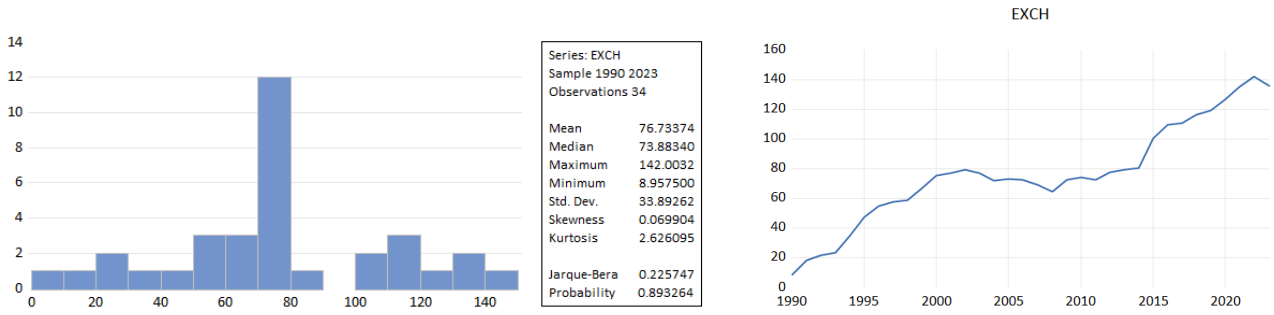
There sults confirm that the series exhibits station arity, as the P-value (probability< 0.05) indicates. The series fluctuates around a constant mean and variance over time. The maximum growth rate was recorded at 9.33% in 2023, while the minimum value was 1.95% in 2019. The mean value of the series was 4.8%, and the dispersion measured by the standard deviation was estimated at 1.46.

3.4Descriptive of Exchange Rate (EX) :

Fig.4:Histogram and Graph Of Exchange Rate 1990-2023

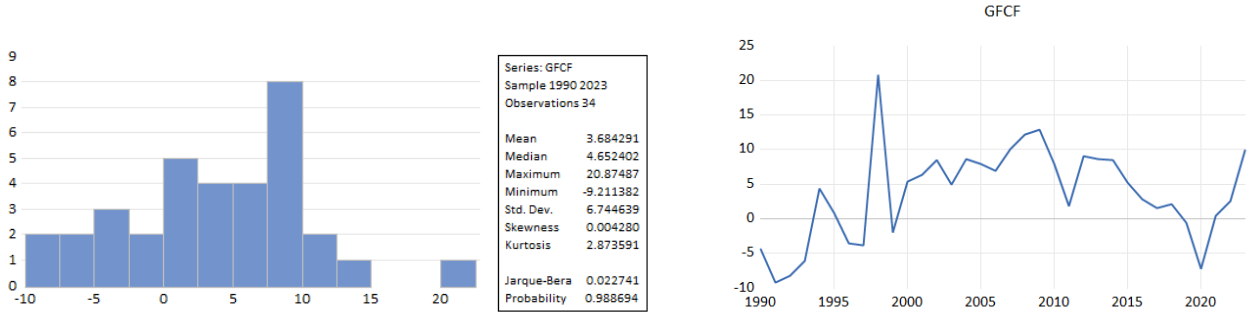


Source:Prepared by author using EViews 12 Software

It is evident that the series is **not stationary**, as the P-value (probability>0.05) indicates. The series does not fluctuate around a constant mean and variance over time, suggesting the presence of a unit root. The maximum growth rate was recorded at 142% in 2022, while the minimum value was 8.957% in 1990. The mean value of the series was 76.73%, and the dispersion measured by the standard deviation was estimated at 33.89.

3.5Descriptive of Gross Fixed Capital Formation (GFCF) (Annual % growth):

Fig.5:Histogram and Graph Of Gross Fixed Capital Formation 1990-2023

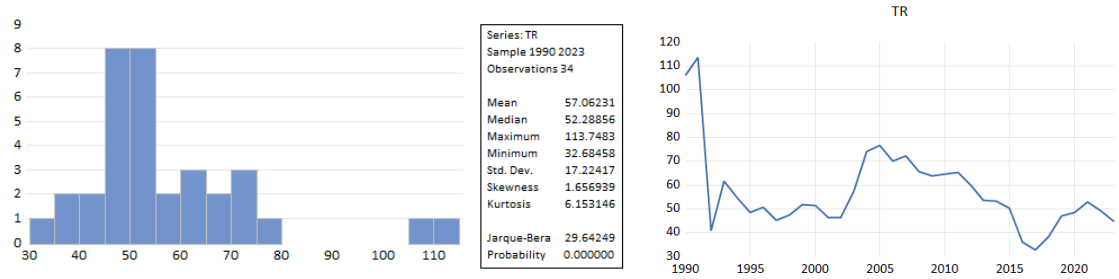


Source: Prepared by author using EViews 12 Software

The results confirm that the series is **not stationary**, as the P-value (probability>0.05) indicates. The series does not fluctuate around a constant mean and variance over time, suggesting the presence of a unit root. The maximum growth rate wasrecorded at 20.87% in 1998, while the minimum value was -9.21% in 1991. The mean value of the series was 3.68%, and the dispersion measured by the standard deviation was estimated at 6.71.

3.6 Descriptive of Trade (TR) (% of GDP):

Fig.6:Histogram and Graph Of Trade 1990-2023



Source:Prepared by authorusing EViews 12 Software

It is evident that the series is stationary, as the P-value (probability< 0.05) indicates. The series fluctuates around a constant mean and variance over time. The maximum growth rate wasrecorded at 113.74% in 1991, while the minimum value was 32.68% in 2017. The mean value of the series was 57.06%, and the dispersion measured by the standard deviation was estimated at 17.22.

4. Empirical analysis and results:

To examine the impact of Foreign Direct Investment (FDI) on economic growth in Algeria, we employ an Autoregressive Distributed Lag (ARDL) cointegration framework, drawing on insights from prior empirical studies ((Driss & Ouahrani, 2023); (Sheikh, Gudaro, & Chhapra , 2012); (Falki, 2009). The analysis utilizes annual time series data spanning the period 1990-2023 and incorporates six key macro economic variables:

- ✓ Growth rate of gross domestic product (GW).
- ✓ Foreign Direct Investment (FDI).

- ✓ Gross Fixed Capital Formation (GFCF).
- ✓ Inflation rate measured by the price index (INF).
- ✓ Logarithm of the official exchange rate (LEX).
- ✓ Trade (% of GDP):sum of exports and imports measured as share of GDP (TR).

The variables and the period of analysis obtained from the World Bank.

4.1 stationary:

4.1.1 Unit root ADF, PP & KPSS test:

The unit root test is used to determine whether or not variables are stationary. The Augmented Dickey-Fuller test (ADF), based on Dickey and Fuller's (1979) work, is used to assess the degree of differentiation required to attain station arity and to evaluate the presence of unit roots. If a non stationary variable becomes stationary after "d" times differentiation, then the order of integrationis said to be "d". The test is based on the estimation of the following regression, which contains both a constant term and a trend:(Touati & Djenidi, 2021, p. 41)

$$\Delta yt = a0 + \gamma yt{-}1{+}a2t + \sum \beta i \Delta yt{-}i{+}1 + \varepsilon tpi{=}2 \quad \ldots\ldots\ldots\ldots\ldots (1)$$

The null hypothesis is: γ= 0, that the series is non stationary and has a unit root. Table 2 summarizes the findings of the Unit root test.
The aim of the KPSS test is to eliminate the series' deterministic trend and make it stationary. The hypotheses differ from those used in the ADF test:
H_0: $Yt \sim I(0)$
H_1:$Yt \sim I(1)$

Table 1: ADF, PP & KPSS Test Results[1]

ADF						
Variables	GW	FDI	GFCF	INF	LEX	TR
Level	-3.7402 P=0.0079	-2.8314 P=0.0648	-2.844 P=0.634	-3.361 P=0.0104	-6.195 P=0.0000	-5.2782 P=0.0001
First Difference	-8.6843 P=0.0000	-5.983 P=0.000	-8.980 P=0.0	-4.827 P=0.0006	-6.466 P=0.00	-8.488 P=0.00
Philips Perron						
Level	-3.7038 P=0.0087	-2.6824 P=0.0878	-3.661 P=0.0096	-0.9644 P=0.754	-5.833 P=0.00	-3.8174 P=0.0065
First Difference	-3.4597 P=0.0	-8.2533 P=0.0	-12.1319 P=0.0	-4.659 P=0.0007	-6.2312 P=0.0000	-7.320 P=0.000
KPSS						
Level	0.15 P=H_0	0.202 P=H_0	0.250 P=H_0	0.493 P=H_1	0.667 P=H_1	0.289 P=H_0
First Difference	0.067 P=H_0	0.228 P=H_0	0.269 P=H_0	0.249 P=H_0	0.423 P=H_0	0.149 P=H_0

Source: Prepared by author using EViews 12 Software

From the resultsobtained in the table 1, shows that the majority of the economic variables are not stationary at level, where the absolute values were lesscritical than the critical value which requires accepting the null hypothesis on the existence of a unit root test, but after taking first

[1] See Appendices N°1 - N°36

difference all the variables has become stable (stationary) at the abstract level 5%, in other words, our series are integrated of order I(0) and I(1).

4.1.2 ACF & PACF function:

Based on the analysis of the ACF and PACF plots, all-time series examined in the images appear to show strong indications of non-stationarity. The most common feature supporting this conclusion is the very slow decay or insufficient decay of the auto correlation function (ACF) over long lags.

At the first difference, it appears that all of the variables are stationary, it appears that all of the variables are stable, which means that the seriesis generally stationary, as all of the P-values are greater than 0.05.

4.2 MODEL:

Recently ,several studies have employed an alternative cointeg ration approach to examine long-run relationships among variables, known as the autoregressive distributed lag (ARDL) bounds test. This methodology was initially developed by(Prasan & Shin, 1996), (Pesaran, 1997), Pesaran and Smith (1998), and (Pesaran M. S., 2001).The ARDL framework integrates elements of autoregressive (AR) models—where lagged values of the dependent variable serve as regressors—and distributed lag (DL) models, which in corporate current and past values of independent variables This model possesses three key advantages:
First, unlike conventional cointegration tests that typically require large sample sizes to ensure result reliability, the ARDL approach remains applicable even in small-sample settings, demonstrating greater efficacy with limited data.
Second, the method accommodates variables with mixed integration orders—whether purelyI(0), purely I(1), or a combination of both—a flexibility absent in traditional cointegration techniques. However, a critical limitation isthat the explanatory variables must not exhibit I(2) or higher-order integration. (Engel & Granger, 1987)

Our study examines the effect of FDI on economic growth in Algeria from 1990 to 2023. Following the empirical investigation our model can be determined as follows:

$$\Delta GW_t = \alpha_0 + \sum_{i=0}^{n} \alpha_{1i} \Delta GW_{t-i} + \sum_{i=0}^{n} \alpha_{2i} \Delta FDI_{t-i} + \sum_{i=0}^{n} \alpha_{3i} \Delta INF_{t-i} + \sum_{i=0}^{n} \alpha_{4i} \Delta LEX_{t-i} + \sum_{i=0}^{n} \alpha_{5i} \Delta GFCF_{t-i} + \sum_{i=0}^{n} \alpha_{6i} \Delta TR_{t-i} + \alpha_{7i} GW_{t-i} + \alpha_{8i} FDI_{t-i} + \alpha_{9i} INF_{t-i} + \alpha_{10i} LEX_{t-i} + \alpha_{11i} GFCF_{t-i} + \alpha_{12i} TR_{t-i} + \alpha_{13i} ECM_{t-i} + \varepsilon_t$$

Where:
$\alpha_0 - \alpha_6$represent the Short Run Parameters.
$\alpha_7 - \alpha_{13}$represent the Long Run Parameters.

4.2.1 Lag length test:

The proper lag length test for the cointegration test was chosen utilizing the VAR framework to ensure agreement of the study finding swith real economic conditions and economic theories. Table 3 below shows the outcome of the lag length selection criterion.
The FPE and AIC criteria supported a lag length 2 (in the annual data, the number of lags is typically small 1 or 2). For the cointegration test and auto regressive distributed lag model, lag length 1 will be employed.

Table 2: Lag Length Test

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-300.0460	NA	15.14661	19.74491	20.02245*	19.83538*
1	-262.5787	58.01392*	14.44710	19.65024	21.59306	20.28355
2	-221.3058	47.92978	13.64593*	19.31005*	22.91815	20.48620

Source: Prepared by author using EViews 12 Softwar

4.2.2 Cointegration Test:

A cointegration test is a statistical procedure used to determine whether two or more non-stationary time series variables sharea long-run equilibrium relationship. Although the individual series maybe non-stationary (i.e., their means and variances change over time), a linear combination of them maybe stationary. If such a stationary combination exists, the variables are said to be cointegrated.

This concept isparticularly important in time seriesanalysis and econometricsbecauseitimpliesthat the variables, despite short-termdeviations, move together over the long term due to some under lying equilibrium mechanism.
The results of the cointegration test in the table below indicate that there are four (04) cointegrating equations at the 0.05 signify an celevel.

Table 3: The Cointegration Test

Date: 05/29/25 Time: 15:41
Sample (adjusted): 1994 2023
Included observations: 30 after adjustments
Trend assumption: Linear deterministic trend
Series: GW DFDI DGFCF DINF DLEX DTR
Lags interval (in first differences): 1 to 2

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.909091	182.9898	95.75366	0.0000
At most 1 *	0.761621	111.0529	69.81889	0.0000
At most 2 *	0.658475	68.03612	47.85613	0.0002
At most 3 *	0.494957	35.80605	29.79707	0.0090
At most 4	0.308115	15.31268	15.49471	0.0532
At most 5 *	0.132454	4.262602	3.841465	0.0390

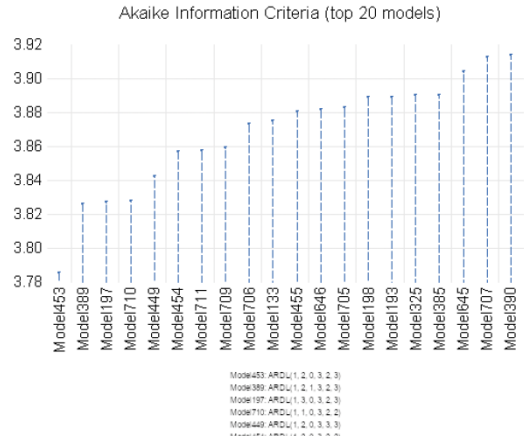
Trace test indicates 4 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Source: Prepared by authorusing EViews 12 Software

4.3 Estimation:

In this step, we proceed with the estimation of the ARDL model. Given that our specified model follows an ARDL (1, 2, 0, 3, 2, 3) structure, the lag selection reflects the optimal balance between model fit and parsimony, as determined by information criteria such as the Akaike Information Criterion (AIC).

Fig.7: AIC top 20 models



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4.3.1 ARDL long run form:

For the Table of results of Autoregressive Distributed Lag (ARDL) model estimation for the dependent variable GW.

The coefficient of Foreign Direct Investment (FDI) (-0.904, statistically in significant) supports the “negative crowding” or crowding-out effect hypothesis, where in foreign direct investment replaces domestic investment without contributing to productivity gains. This phenomenonis particularly pronounced in resource-rich economies dominated by the state, such as Algeria.

The results are also in line with(Alfaro, 2017), which finds that FDI inflows into rentier economies are often concentrated in extractive sectors such as oil. Theses ectors typically operate in isolation from the broad erdomestic economy and fail to establishstrong productive linkages with other areas like manufacturing, agriculture, or services.

In other words, when foreign investors enter a rentier economy, they tend to limittheiractivities to resource extraction and export, withoutinvesting in sectorsthatstimulate the macroeconomy or fosterdomestic production networks. As a result, the direct economicbenefits to the host country such as technologytransfer, sustainable job creation, and the development of local skillsremain minimal.

Absence of "Local Content Requirements" policiesreduces the connectionbetween FDI and the local economy (Hirschman’s Linkage Theory). Thesepoliciesrequireforeigncompanies to use a certain percentage of input (materials, labor, services) from the local market.

On the other hand, we observe a strong positive impact of Domestic Investment (GFCF) (0.275, p-value = 0.001) in the current period, which diminishes over time, as indicated by the negative coefficients for the second and third lags. This reflects: Efficiency of domestic investment in the short term, but it may suffer from poor management or unsustain able financing.
The resultal so show a negative impact of Inflation (INF) (-1.140, p-value = 0.05) with a two-year lag, supporting the hypothesis that high inflation harms growth in the medium term.

As for the exchange rate, it had a positive and significant impact (0.508 and 11.951) with a one-year lag, suggesting that currency depreciation (weakening of the Dinar) may stimulate non-oil exports. However, the effect turns negative (-14.279) after three years, reflecting the consequences of imported inflation.

Finally, the coefficient of trade coefficient was insignificant across all periods. This indicates Algeria's dependence on oil exports, which restricts the impact of trade on economic growth.

4.3.2 Error Correction Method:

The Error Correction Model (ECM) is a dynamic econometric specification that reconciles short-term fluctuations with long-term equilibrium relationships among cointegrated non-stationary variables. It decomposes the adjustment process into:

Short-term dynamics: Captures immediate effects of changes in independent variables.
Error correction term (ECT): Quantifies the speed at which the system reverts to its long-run equilibrium after a deviation, with the coefficient (typically denoted as α) constrained to be negative for stability(Engel & Granger, 1987). As such as The estimation results included in Table 4below:

A. Short-Run Dynamics:

- ✓ $\Delta \boldsymbol{FDI}$: exhibits a negative but statistically insignificant contemporaneous effect on growth (coefficient = -0.904, p = 0.163). However, the first lag of FDI (ΔFDI(-1)) is significant at the 10% level (coefficient = -1.270, p = 0.053), suggesting a delayed adverse effect on economic growth. This may reflect structural inefficiencies in absorbing FDI spillovers in the short run.

- ✓ $\Delta \boldsymbol{INF}$: has a positive and significant immediate impact (coefficient = 0.627, p = 0.020), possibly indicating short-run demand-pull growth effects. However, lagged inflation (ΔINF(-1) and ΔINF(-2)) show strong negative effects (coefficients = -1.334 and -2.475, p < 0.01), implying that sustained inflation erodes growth over time, consistent with stationary pressures.
- ✓ $\Delta \boldsymbol{LEX}$: The contemporaneous exchange rate change (ΔLEX) is insignificant (p = 0.835), but ΔLEX(-1) has a highly significant positive coefficient (14.279, p = 0.000), suggesting that currency depreciation may boost growth with a one-period lag, likely through export competitiveness.

- ✓ **ΔTR**: While ΔTR is insignificant, its first and second lags (ΔTR(-1) and ΔTR(-2)) show positive and significant effects (coefficients = 0.150 and 0.131, p < 0.10), indicating that trade's growth-enhancing effects materialize with a delay, possibly due to adjustment costs.

B. Long-Run Equilibrium & Error Correction:

The **Error Correction Term (ECT(-1))** is **highly significant(coefficient = -0.533, p = 0.000)**, confirming a stable long-run relationship among variables.

- ✓ The negative sign aligns with theoretical expectations, indicating that **53.3% of disequilibrium is corrected annually** towards the long-run steady state.
- ✓ The magnitude suggests **moderate adjustment speed**, implying that policy interventions may take nearly two years to fully manifest in growth outcomes.

Diagnostics of Model:

- ✓ The **high R^2 (0.875)** and **Adjusted R^2 (0.813)** indicate strong explanatory power.
- ✓ The **Durbin-Watson statistic (2.464)** suggests no severe autocorrelation.

Table 4: ARDL Error Correction RegressionResults

ARDL Error Correction Regression
Dependent Variable: D(GW)
Selected Model: ARDL(1, 2, 0, 3, 2, 3)
Case 2: Restricted Constant and No Trend
Date: 05/29/25 Time: 14:06
Sample: 1990 2023
Included observations: 31

ECM Regression
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(FDI)	-0.904199	0.613556	-1.473701	0.1627
D(FDI(-1))	-1.270243	0.599694	-2.118151	0.0525
D(INF)	0.626861	0.238441	2.628999	0.0198
D(INF(-1))	-1.334460	0.319233	-4.180209	0.0009
D(INF(-2))	-2.474934	0.340154	-7.275924	0.0000
D(LEX)	0.508575	2.390029	0.212790	0.8346
D(LEX(-1))	14.27928	2.638733	5.411416	0.0001
D(TR)	-0.006683	0.054659	-0.122267	0.9044
D(TR(-1))	0.150469	0.064012	2.350652	0.0339
D(TR(-2))	0.131063	0.068783	1.905453	0.0775
CointEq(-1)*	-0.533133	0.056223	-9.482515	0.0000

R-squared	0.875469	Mean dependent var	0.080645
Adjusted R-squared	0.813204	S.D. dependent var	2.673377
S.E. of regression	1.155431	Akaike info criterion	3.398246
Sum squared resid	26.70040	Schwarz criterion	3.907080
Log likelihood	-41.67281	Hannan-Quinn criter.	3.564113
Durbin-Watson stat	2.464229		

* p-value incompatible with t-Bounds distribution.

Source:Prepared by authorusing EViews 12 Software

4.3.3 Bound Test:

The bounds testing methodology examines whether a long-run equilibrium relationship exists between a dependent variable and its explanatory variables. This approach utilizes conventional F-statistics and t-statistics to evaluate the significance of lagged level variables within a first-difference dregression framework. The procedure employs two distinct sets of asymptotic critical values: one set assumes all regressors are integrated of order one I(1), while the other assumes they are integrated of order zero I(0). These critical value bounds accommodate various possible combinations of regressor integration orders, including scenarios where variables exhibit mixed integration properties or mutual cointegration.
This methodologyprovesparticularlyvaluablewhenuncertaintyexistsregarding the integration properties of the variables under examination. The testing procedure involves comparing the computed F-statistic against established critical value bounds. When the test statistic exceeds

the upper bound critical value for I(1) variables, this provides strong evidence for cointegration. Conversely, if the statistic falls below the lower bound for I(0) variables, no cointegration exists. Intermediate values require further investigation.

In the current analysis employing an ARDL(1,2,0,3,2,3) specification, the computed F-statistic (F_{cal}= 8.991808) for the growth model exceeds the 5% significan celevelupper bound critical value (as referenced in standard critical value tables). This finding leads to the rejection of the null hypothesis of no cointegration, confirming the presence of a stable long-run relationship among the examined variables. The results demonstrate that the variables move together in equilibrium over time, despite potential short-run deviations.

This cointegration evidence validates the use of an error correction modeling framework, which can effectively capture both short-run dynamics and long-run equilibrium adjustments in the relationship between the variables. The finding has importantes implications for economic modeling and policy analysis, as it confirms the existence of a stable long-run relationship that can inform structural economic interpretations.

Table 5: Bounds test results

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
		Asymptotic: n=1000		
F-statistic	8.991808	10%	2.08	3
k	5	5%	2.39	3.38
		2.5%	2.7	3.73
		1%	3.06	4.15
Actual Sample Size	31	Finite Sample: n=35		
		10%	2.331	3.417
		5%	2.804	4.013
		1%	3.9	5.419
		Finite Sample: n=30		
		10%	2.407	3.517
		5%	2.91	4.193
		1%	4.134	5.761

Source:Prepared by authorusing EViews 12 Software

4.4 StatisticalAnalysis:

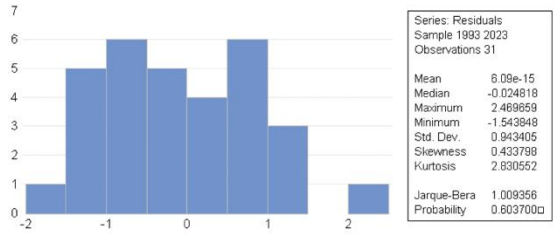
Statistical tests play a fundamental role in econometric modeling by ensuring the validity of empirical results and the reliability of inferences. Before drawing conclusions from any regression analysis, researchers must verify whether the under lying statistical assumptions hold true. Key diagnostic tests including normality tests, autocorrelation tests (LM test), hetero skedasticity tests (ARCH test), and other specification checks are essential for assessing model adequacy and detecting potential misspecifications.

4.4.1 Normalitytest:

In statistics, the normality test is a statistical procedure used to determine whether a given dataset or a set of residuals (errors) from a statistical model follows a normal (Gaussian) distribution.

Figure 8 presents the results of the normality test. The probability value (p-value) exceeds the 0.05 signific an celevel, indicating that the residuals are normally distributed.

Fig.8: The normality Test



Source:Prepared by authorusing EViews 12 Software

4.4.2 HeteroskedasticityTest:

Hetero ske dasticity tests are statistical procedures used to detect whether the variance of errors (residuals) in a regression model is non-constant across observations. This violates the classicallinearregressionassumption of homoskedasticity (constant error variance).

A. Breusch Pagan-Godfrey:

The hetero ske dasticity diagnostic using the Breusch-Pagan-Godfrey procedure yielded statistically in significant results (p-value = 0.8376), confirming that the constant variance assumption holds for our regression model. This conclusion is corroborated by multiple test statistics (F-statistic = 0.450, Obs*R-squared = 10.528), demonstrating the reliability of our estimation methodology.

Table 6: Breusch Pagan-Godfrey test

Heteroskedasticity Test: Breusch-Pagan-Godfrey
Null hypothesis: Homoskedasticity

F-statistic	0.449995	Prob. F(16,14)	0.9361
Obs*R-squared	10.52822	Prob. Chi-Square(16)	0.8376
Scaled explained SS	1.965350	Prob. Chi-Square(16)	1.0000

Source:Prepared by authorusing EViews 12 Software

B. ARCH test:

The presented results derive from an ARCH (Auto regressive Conditional Heteroske dasticity) test, a specialized diagnostic examining whether residual variance exhibits time-dependent clustering patterns common in financial/economic time series.

Diagnostic testing for auto regressive conditional heteroske dasticity (ARCH) revealed in the table below no statisticallysignificantevidence of volatility clustering (F=0.127, P-value=0.724), supporting the appropriateness of conventional estimation approaches for this temporal dataset.

Table 7: ARCH test results

Heteroskedasticity Test: ARCH

F-statistic	0.126822	Prob. F(1,28)	0.7244
Obs*R-squared	0.135268	Prob. Chi-Square(1)	0.7130

Source:Prepared by authorusing EViews 12 Software

C. LM test:

Diagnostic testing using the LM test procedure revealed no evidence of serial correlation in the residuals (P > 0.10), confirming the appropriateness of the specified dynamic structure in our ARDL model.

Table 8: LM test results

Breusch-Godfrey Serial Correlation LM Test:
Null hypothesis: No serial correlation at up to 2 lags

F-statistic	1.005297	Prob. F(2,12)	0.3948
Obs*R-squared	4.448662	Prob. Chi-Square(2)	0.1081

Source:Prepared by authorusing EViews 12 Software

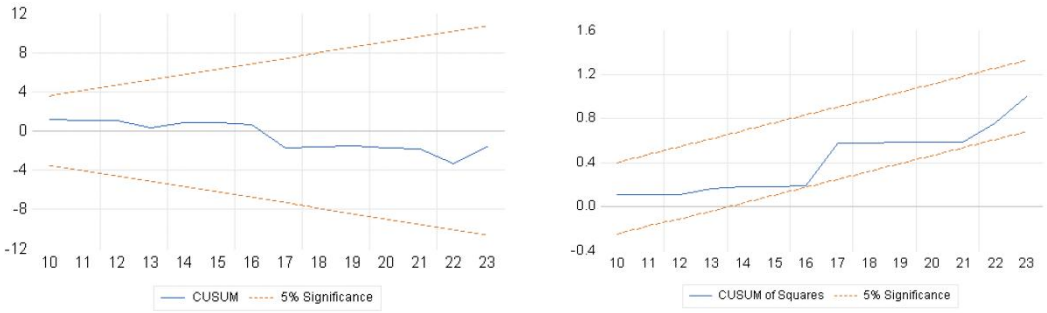
4.4.3 Stability test:

In econometric modeling, ensuring the reliability and robustness of empirical results is crucial for valid inference. One key aspect of this validation process is stability testing, which examines whether the estimated parameters of a model (like mean, variance, and autocorrelation) remain consistent over time or a cross different ample periods.

A. The CUSUM and CUSUM of Squares test:

The CUSUM (Cumulative Sum) test evaluates the stability of regression coefficients over time by tracking cumulative deviations of recursiveis duals.
the CUSUM stability test (Figure 9 on the left) demonstrates all recursiveresi duals remain with in 5% significance bounds throughout 2010-2023, confirming parameterconstancy (Brown et al., 1975). This structural stability suggests our ARDL estimate esreli ably capture persistent economic relationship sun affected by regime shifts.

Fig.9: CUSUM and CUSUM of Squares test



Source: Prepared by author using EViews 12 Software

The CUSUM of Squares test (Figure 9 on the right) demonstrates stable residual variance throughout 2010-2023, with the test statistic remaining with in 5% critical bounds. This confirmsourmodel'serrorpropertiessatisfyhomoskedasticityassumptions over time, reinforcing the validity of statistical inferences.

5. CONCLUSION

The empirical results reveal that FDI has not contributed meaningfully to Algeria's long-term economic growth. Instead, its negative and insignificant impact reflects the structural constraints of a resource-dependent economy where foreign investment remains concentrated in the hydrocarbon sector, with limited spillovers to productive industries. By contrast, domestic investment emerges as a key short-term driver of growth, although its effects diminish over time, underscoring the need for deeper institutional and financial reforms.

Inflation and exchange rate dynamics play a decisive role: persistent inflation undermines growth, while exchange rate depreciation has mixed effects depending on the time horizon. Trade openness does not significantly stimulate growth, largely because the country's export structure remains undiversified and dominated by crude oil.

Overall, the findings emphasize the urgent need for Algeria to adopt a comprehensive development strategy that strengthens economic diversification, enhances the business environment, and implements effective local-content policies. Such reforms are essential to transform FDI from activity limited to the hydrocarbon sector into a genuine driver of sustainable growth, technological advancement, and structural transformation.

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7. APPENDICES:

N°1 :ADF GW Level Intercept.

Null Hypothesis: GW has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.740293	0.0079
Test critical values:	1% level	-3.646342	
	5% level	-2.954021	
	10% level	-2.615817	

*MacKinnon (1996) one-sided p-values.

N°3: ADF FDI Level Intercept

Null Hypothesis: FDI has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.831444	0.0648
Test critical values:	1% level	-3.646342	
	5% level	-2.954021	
	10% level	-2.615817	

*MacKinnon (1996) one-sided p-values.

N°2: ADF GW 1st Difference InterceptN°4: ADF FDI 1st Difference Intercept

Null Hypothesis: D(GW) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-8.684372	0.0000
Test critical values:	1% level	-3.653730	
	5% level	-2.957110	
	10% level	-2.617434	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(FDI) has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.983255	0.0000
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

*MacKinnon (1996) one-sided p-values.

N°5: ADF GFCF Level Intercept.

Null Hypothesis: GFCF has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.844292	0.0634
Test critical values:	1% level	-3.653730	
	5% level	-2.957110	
	10% level	-2.617434	

*MacKinnon (1996) one-sided p-values.

N°6: ADF GFCF 1st Difference Intercept

Null Hypothesis: D(GFCF) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-8.980495	0.0000
Test critical values:	1% level	-3.653730	
	5% level	-2.957110	
	10% level	-2.617434	

*MacKinnon (1996) one-sided p-values.

N°7: ADF INF Level Intercept.

N°8: ADF INF 1st Difference Intercept

Null Hypothesis: D(INF) has a unit root
Exogenous: Constant
Lag Length: 3 (Automatic - based on SIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.827201	0.0006
Test critical values:	1% level	-3.679322	
	5% level	-2.967767	
	10% level	-2.622989	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: INF has a unit root
Exogenous: None
Lag Length: 4 (Automatic - based on SIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		1.398131	0.9560
Test critical values:	1% level	-2.647120	
	5% level	-1.952910	
	10% level	-1.610011	

*MacKinnon (1996) one-sided p-values.

N°9: ADF LEX Level Intercept.

Null Hypothesis: LEX has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 6 (Automatic - based on SIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.482728	0.3332
Test critical values:	1% level	-4.339330	
	5% level	-3.587527	
	10% level	-3.229230	

*MacKinnon (1996) one-sided p-values.

N°10: ADF LEX 1st Difference Intercept

Null Hypothesis: D(LEX) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.466966	0.0000
Test critical values:	1% level	-3.653730	
	5% level	-2.957110	
	10% level	-2.617434	

*MacKinnon (1996) one-sided p-values.

N°11: ADF TR Level Intercept.

Null Hypothesis: TR has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 2 (Automatic - based on SIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.731101	0.9615
Test critical values:	1% level	-4.284580	
	5% level	-3.562882	
	10% level	-3.215267	

*MacKinnon (1996) one-sided p-values.

N°12: ADF TR 1st Difference Intercept

Null Hypothesis: D(TR) has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-8.488839	0.0000
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

*MacKinnon (1996) one-sided p-values.

N°13:Philips–Perron GW Level Intercept.

Null Hypothesis: GW has a unit root
Exogenous: Constant
Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-3.703828	0.0087
Test critical values:	1% level	-3.646342	
	5% level	-2.954021	
	10% level	-2.615817	

*MacKinnon (1996) one-sided p-values.

N°14:Philips–Perron GW 1st Difference Intercept

Null Hypothesis: D(GW) has a unit root
Exogenous: Constant
Bandwidth: 3 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-9.459748	0.0000
Test critical values:	1% level	-3.653730	
	5% level	-2.957110	
	10% level	-2.617434	

*MacKinnon (1996) one-sided p-values.

N°15:Philips–Perron FDI Level Intercept

Null Hypothesis: FDI has a unit root
Exogenous: Constant
Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.682410	0.0878
Test critical values:	1% level	-3.646342	
	5% level	-2.954021	
	10% level	-2.615817	

*MacKinnon (1996) one-sided p-values.

N°16: Philips–Perron FDI 1st Difference Intercept

Null Hypothesis: D(FDI) has a unit root
Exogenous: Constant
Bandwidth: 5 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-8.253343	0.0000
Test critical values:	1% level	-3.653730	
	5% level	-2.957110	
	10% level	-2.617434	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.210103
HAC corrected variance (Bartlett kernel)	0.126930

N°17:Philips–Perron GFCF Level Intercept.

Null Hypothesis: GFCF has a unit root
Exogenous: Constant
Bandwidth: 0 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-3.661096	0.0096
Test critical values:	1% level	-3.646342	
	5% level	-2.954021	
	10% level	-2.615817	

*MacKinnon (1996) one-sided p-values.

N°18:Philips–Perron GFCF 1st Difference Intercept

Null Hypothesis: D(GFCF) has a unit root
Exogenous: Constant
Bandwidth: 17 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-12.13192	0.0000
Test critical values:	1% level	-3.653730	
	5% level	-2.957110	
	10% level	-2.617434	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	41.31243
HAC corrected variance (Bartlett kernel)	15.34026

N°19:Philips–Perron INF Level Intercept.

Null Hypothesis: INF has a unit root
Exogenous: None
Bandwidth: 13 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		1.467254	0.9618
Test critical values:	1% level	-2.636901	
	5% level	-1.951332	
	10% level	-1.610747	

*MacKinnon (1996) one-sided p-values.

N°20:Philips–Perron INF 1st Difference Intercept

Null Hypothesis: D(INF) has a unit root
Exogenous: Constant
Bandwidth: 29 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-4.659555	0.0007
Test critical values:	1% level	-3.653730	
	5% level	-2.957110	
	10% level	-2.617434	

*MacKinnon (1996) one-sided p-values.

N°21:Philips–Perron LEX Level Intercept.

Null Hypothesis: LEX has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 0 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-6.066046	0.0001
Test critical values:	1% level	-4.262735	
	5% level	-3.552973	
	10% level	-3.209642	

*MacKinnon (1996) one-sided p-values.

N°22:Philips–Perron LEX 1st Difference Intercept

Null Hypothesis: D(LEX) has a unit root
Exogenous: Constant
Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-6.231203	0.0000
Test critical values:	1% level	-3.653730	
	5% level	-2.957110	
	10% level	-2.617434	

*MacKinnon (1996) one-sided p-values.

N°23:Philips–Perron TR Level Intercept.

Null Hypothesis: TR has a unit root
Exogenous: None
Bandwidth: 9 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-0.369503	0.5437
Test critical values:	1% level	-2.636901	
	5% level	-1.951332	
	10% level	-1.610747	

*MacKinnon (1996) one-sided p-values.

N°24:Philips–Perron TR 1st Difference Intercept

Null Hypothesis: D(TR) has a unit root
Exogenous: Constant
Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-7.320797	0.0000
Test critical values:	1% level	-3.653730	
	5% level	-2.957110	
	10% level	-2.617434	

*MacKinnon (1996) one-sided p-values.

N°25: KPSS GW Level Intercept.

Null Hypothesis: GW is stationary
Exogenous: Constant
Bandwidth: 3 (Newey-West automatic) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.150083
Asymptotic critical values*:	1% level	0.739000
	5% level	0.463000
	10% level	0.347000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

N°26: KPSS GW 1st DifferenceIntercept

Null Hypothesis: D(GW) is stationary
Exogenous: Constant
Bandwidth: 3 (Newey-West automatic) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.067589
Asymptotic critical values*:	1% level	0.739000
	5% level	0.463000
	10% level	0.347000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

N°27: KPSS FDI Level InterceptN°28: KPSS FDI 1st Difference Intercept

Null Hypothesis: FDI is stationary
Exogenous: Constant, Linear Trend
Bandwidth: 4 (Newey-West automatic) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.178213
Asymptotic critical values*:	1% level	0.216000
	5% level	0.146000
	10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Null Hypothesis: D(FDI) is stationary
Exogenous: Constant
Bandwidth: 6 (Newey-West automatic) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.228375
Asymptotic critical values*:	1% level	0.739000
	5% level	0.463000
	10% level	0.347000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	0.224248
HAC corrected variance (Bartlett kernel)	0.074522

N°29: KPSS GFCF Level InterceptN°30: KPSS GFCF 1st Difference Intercept

Null Hypothesis: GFCF is stationary
Exogenous: Constant
Bandwidth: 4 (Newey-West automatic) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.250288
Asymptotic critical values*:	1% level	0.739000
	5% level	0.463000
	10% level	0.347000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Null Hypothesis: D(GFCF) is stationary
Exogenous: Constant
Bandwidth: 20 (Newey-West automatic) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.269557
Asymptotic critical values*:	1% level	0.739000
	5% level	0.463000
	10% level	0.347000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	51.71773
HAC corrected variance (Bartlett kernel)	5.606668

N°31: KPSS INF Level Intercept

Null Hypothesis: INF is stationary
Exogenous: Constant
Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.493657
Asymptotic critical values*:	1% level	0.739000
	5% level	0.463000
	10% level	0.347000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

N°32: KPSS INF 1st Difference Intercept

Null Hypothesis: D(INF) is stationary
Exogenous: Constant
Bandwidth: 12 (Newey-West automatic) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.249028
Asymptotic critical values*:	1% level	0.739000
	5% level	0.463000
	10% level	0.347000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

N°33: KPSS LEX Level Intercept

Null Hypothesis: LEX is stationary
Exogenous: Constant, Linear Trend
Bandwidth: 4 (Newey-West automatic) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.135058
Asymptotic critical values*:	1% level	0.216000
	5% level	0.146000
	10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

N°34: KPSS LEX 1st Difference Intercept

Null Hypothesis: D(LEX) is stationary
Exogenous: Constant
Bandwidth: 4 (Newey-West automatic) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.423708
Asymptotic critical values*:	1% level	0.739000
	5% level	0.463000
	10% level	0.347000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

N°35: KPSS TR Level Intercept.

Null Hypothesis: TR is stationary
Exogenous: Constant
Bandwidth: 4 (Newey-West automatic) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.184782
Asymptotic critical values*:	1% level	0.739000
	5% level	0.463000
	10% level	0.347000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

N°36: KPSS TR 1st Difference Intercept

Null Hypothesis: D(TR) is stationary
Exogenous: Constant
Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.149361
Asymptotic critical values*:	1% level	0.739000
	5% level	0.463000
	10% level	0.347000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

N°37: ARDL Long Run Form

Dependent Variable: GW
Method: ARDL
Date: 05/29/25 Time: 13:53
Sample (adjusted): 1993 2023
Included observations: 31 after adjustments
Maximum dependent lags: 1 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (3 lags, automatic): FDI GFCF INF LEX TR
Fixed regressors: C
Number of models evaluated: 1024
Selected Model: ARDL(1, 2, 0, 3, 2, 3)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
GW(-1)	0.466867	0.159462	2.927768	0.0110
FDI	-0.904199	0.921065	-0.981688	0.3429
FDI(-1)	2.115805	0.890622	2.375649	0.0323
FDI(-2)	1.270243	0.882624	1.439167	0.1721
GFCF	0.275825	0.070862	3.892437	0.0016
INF	0.626861	0.396564	1.580730	0.1363
INF(-1)	0.900825	0.598413	1.505357	0.1545
INF(-2)	-1.140474	0.542945	-2.100535	0.0543
INF(-3)	2.474934	0.908867	2.723097	0.0165
LEX	0.508575	4.105003	0.123891	0.9032
LEX(-1)	11.95114	5.677113	2.105143	0.0538
LEX(-2)	-14.27928	3.641490	-3.921274	0.0015
TR	-0.006683	0.075861	-0.088095	0.9310
TR(-1)	-0.060865	0.105212	-0.578497	0.5721
TR(-2)	-0.019406	0.107834	-0.179962	0.8598
TR(-3)	-0.131063	0.091774	-1.428110	0.1752
C	4.064089	5.944540	0.683668	0.5053

R-squared	0.838892	Mean dependent var	2.803226
Adjusted R-squared	0.654768	S.D. dependent var	2.350388
S.E. of regression	1.381004	Akaike info criterion	3.785343
Sum squared resid	26.70040	Schwarz criterion	4.571723
Log likelihood	-41.67281	Hannan-Quinn criter.	4.041683
F-statistic	4.556134	Durbin-Watson stat	2.464229
Prob(F-statistic)	0.003369		

*Note: p-values and any subsequent tests do not account for model selection.