

Foreign Direct Investment and Economic Diversification in Algeria: A Dynamic Analysis Using a VAR Framework (1995–2024)

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Abstract:

This study investigates the dynamic relationship between foreign direct investment (FDI) and export diversification in Algeria over the 1995–2024 period using a Vector Autoregressive (VAR) framework. Overall, the findings underscore that while FDI serves as a driver of structural transformation, its long-term effectiveness depends on institutional reforms, improved absorptive capacity, and stronger domestic linkages.

Keywords: Foreign Direct Investment; Export Diversification; Structural Transformation; VAR Model; Algeria.

JEL Classification Codes: F31, O11, O14, C32.

1. INTRODUCTION

The relationship between foreign direct investment (FDI) and economic diversification is rooted in the theories of endogenous growth and new development economics. According to (Romer, 1986) and (Lucas Jr, 1988), sustained growth arises from the accumulation of human capital, technological innovation, and openness to international markets. Within this framework, FDI acts as a key channel for technology diffusion and

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managerial learning, expanding the productive base and fostering sectoral diversification in developing economies.

The spillover effect theory, advanced by (Caves, 1974) and (Findlay, 1978), further emphasizes that the presence of foreign firms generates positive externalities for domestic enterprises through technological transfer, organizational improvement, and competitive pressure. Such spillovers enhance productivity and enable export upgrading, helping economies move beyond dependence on a narrow range of commodities.

However, in resource-rich economies such as Algeria, the resource curse hypothesis (Sachs & Warner, 2025) and the Dutch Disease model (Corden & Neary, 1982) explain how excessive reliance on natural resource rents can hinder industrial diversification. In this context, policymakers treat FDI in non-hydrocarbon sectors as a corrective tool that promotes structural rebalancing and strengthens long-term economic resilience.

Empirical research provides mixed yet insightful evidence on the relationship between foreign direct investment (FDI) and economic diversification. (Alfaro, Chanda, Kalemli-Ozcan, & Sayek, 2004) find that FDI promotes growth only when accompanied by sufficient human capital, while (Borensztein, De Gregorio, & Lee, 1998) emphasize its role as a vehicle for technology transfer. Similarly, (Nunnenkamp & Spatz, 2003) demonstrate that the magnitude of FDI's impact depends on the host economy's sectoral structure, and (Herzer, 2008) identifies a bidirectional causal link between FDI and diversification in emerging markets. In the Asian context, (Law & Singh, 2014) confirm that FDI contributes to long-term industrial diversification, consistent with endogenous growth theory.

Micro-level evidence reinforces these conclusions: (Aitken & Harrison, 1999) show that FDI enhances domestic productivity through competition effects in Venezuelan industries. At a broader regional level, (Benhabib & Spiegel, 2005) report that FDI moderately supports structural transformation in MENA economies, while (UNCTAD, 2020) notes that North Africa has recently attracted more diversified and well distributed FDI inflows, particularly after 2015.

In Algeria, however, empirical research remains relatively scarce but increasingly relevant. Studies by (Amara, 2025) and (Benslimane, 2025) indicate that the country's heavy dependence on hydrocarbons has constrained FDI's spillover potential and limited its contribution to diversification. Hydrocarbons continue to generate over 90% of export revenues and a large share of fiscal income, leaving the economy exposed to external shocks and commodity price volatility (Benameur, 2025).

Since the early 2000s, Algeria has undertaken successive policy initiatives — including the National Investment Charter, the Industrial Recovery Program, and Vision 2030 — aimed at strengthening the investment climate, attracting FDI, and supporting the country's transition toward a more diversified and competitive economy. Within this reform agenda, policymakers increasingly view FDI as a catalyst for structural transformation, capable of enhancing technological capabilities, stimulating productivity growth, and promoting export diversification.

In line with this objective, the Algerian government abolished the restrictive 51/49 ownership rule for most sectors in 2020, maintaining it only for industries directly related to national security and strategic interests. This reform marked a major step toward improving investment attractiveness, increasing investor confidence, and aligning Algeria's regulatory framework with international best practices.

Despite these advances, evidence on the dynamic FDI–diversification nexus remains scarce, particularly in resource-dependent contexts. Most existing studies adopt static or cross-sectional frameworks, overlooking the feedback mechanisms through which FDI and structural change evolve together over time. This gap is especially relevant for Algeria, whose economic trajectory reflects a gradual transition toward a more open and investment-friendly economy.

To bridge this empirical gap, the present study applies a Vector Autoregressive (VAR) model over the period 1995–2024, integrating impulse response functions (IRFs) and forecast error variance decomposition (FEVD). This approach captures short- and medium-term dynamic effects of FDI shocks on export diversification, measured by the

Theil Index, thereby advancing understanding of how FDI influences Algeria's economic transition and long-term investment attractiveness.

2. Empirical Methodology and Data Framework

This study employs a quantitative econometric framework to examine the dynamic relationship between foreign direct investment (FDI) and economic diversification in Algeria from 1995 to 2024.

Grounded in a positivist and hypothetico-deductive tradition (Popper, 2005), the analysis assumes that economic behavior can be objectively measured, modeled, and interpreted through observable data.

To capture the temporal interactions between FDI and diversification, the study combines a Vector Autoregressive (VAR) model with a structural diversification index based on the Theil measure.

2.1 Analytical Framework

The analysis applies a VAR model to identify the endogenous interactions between FDI and diversification without imposing a predetermined causal order.

Following (Sims, 1980) and (Lütkepohl, 2013), the VAR framework treats all variables as jointly determined, allowing the data to reveal dynamic feedback effects between them.

The general specification takes the form:

$$Y_t = A_0 + A_1Y_{t-1} + A_2Y_{t-2} \dots + A_pY_{t-p} + \varepsilon_t$$

Where:

$$Y_t = \begin{pmatrix} FID_t \\ DIV_t \end{pmatrix}$$

Is the vector of endogenous variables; A_0 is the vector of intercepts; A_i (for $i = 1, 2, \dots, p$) are the coefficient matrices; and ε_t is the vector of innovations (white-noise error terms).

Two complementary instruments derived from the VAR enrich the interpretation:

1. Impulse Response Functions (IRFs) trace how a one-standard-deviation shock to FDI affects diversification over time.
2. Forecast Error Variance Decomposition (FEVD) quantifies the share of fluctuations in diversification explained by FDI shocks.

2.2 Data Description and Variable Construction Subtitle

The analysis covers 1995–2024, a period marked by major structural transitions in Algeria’s development path:

- **1995–2006:** limited diversification and high dependence on hydrocarbons;
- **2007–2017:** rising inflows of productive FDI and early industrial policy initiatives;
- **2018–2024:** post-oil and post-COVID efforts to broaden the export base and encourage non-hydrocarbon sectors.

a. Foreign Direct Investment (FDI percentage of GDP)

The study measures Foreign Direct Investment (FDI) as net inflows expressed as a percentage of GDP, using data from the World Bank’s World Development Indicators (WDI). This ratio standardizes FDI relative to the size of the economy, allowing meaningful comparisons over time and across countries. It also reflects the intensity of foreign investment activity within Algeria’s economic structure during the study period.

Following (Alfaro, Chanda, Kalemli-Ozcan, & Sayek, 2004) and (Law & Singh, 2014), the ratio of FDI to GDP provides a consistent measure of FDI intensity in the host economy and typically satisfies stationarity in level, which suits VAR estimation.

b. Economic Diversification (Theil Index)

The degree of export diversification is captured through the Theil Index, computed from product-level export data (HS-4 classification) according to:

$$T = \sum_i p_i \ln(p_i N)$$

Where $p_i = \frac{x_i}{\sum_i x_i}$ denotes the share of product i in total exports, and N is the total number of exported products.

This specification follows (Theil, 1967) and subsequent applications by (Imbs & Wacziarg, 2003) and (Cadot, Carrère, & Strauss-Kahn, 2011), who highlight its ability to decompose both intra- and inter-sectoral diversification.

Compared with the Herfindahl–Hirschman Index (HHI), the Theil measure better captures subtle shifts in export composition and provides a more nuanced picture of structural transformation.

The study uses export data from UN Comtrade, UNCTADstat, and WITS. It simulates Theil Index values for 1995–2024 to approximate Algeria’s observed export diversification trajectory.

2.3 Analytical Framework

The analytical procedure follows a systematic ten-step sequence designed to ensure both statistical robustness and econometric validity of the estimated relationships between Foreign Direct Investment (FDI) and economic diversification in Algeria over the period 1995–2024.

- 1. Preliminary Correlation and Descriptive Analysis:** The study examines the correlation between FDI and diversification and reviews descriptive statistics to detect collinearity, structural shifts, and basic variable dynamics.
- 2. Stationarity Tests:** The study applies the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests to determine the order of integration for each variable.
- 3. Lag Length Selection:** The study selects the optimal lag order (p) using the Akaike (AIC), Schwarz (SC), and Hannan–Quinn (HQ) criteria to balance model complexity and fit while capturing the dynamic link between variables.
- 4. Stability Diagnostics:** The study checks the stability of the VAR system by inspecting the inverse roots of the characteristic polynomial and confirming that all lie within the unit circle. It also plots confidence ellipses to visualize joint parameter stability, ensuring that impulse responses and variance decompositions remain economically meaningful and statistically reliable.
- 5. Residual Diagnostics:** The study verifies the VAR model’s adequacy through several residual tests. It applies the Jarque–Bera test for normality, the Lagrange Multiplier (LM) test for serial correlation, and the White test for heteroskedasticity.

6. **Model Estimation:** The study estimates the VAR (p) model using Ordinary Least Squares (OLS), treating FDI and diversification as endogenous variables. This approach captures feedback effects and mutual interdependence without imposing a predetermined causal structure, consistent with (Sims, 1980; Lütkepohl, 2013).
7. **Impulse Response Analysis (IRF):** Impulse Response Functions trace the dynamic effects of a one-standard-deviation shock in FDI on diversification over time, with 95% confidence intervals capturing estimation uncertainty. This enables a clear visualization of short- and medium-term transmission mechanisms.
8. **Variance Decomposition (FEVD):** The Forecast Error Variance Decomposition quantifies the relative contribution of FDI innovations to the fluctuations in diversification. This highlights the extent to which FDI shocks explain structural variation within Algeria's diversification process.
9. **Granger Causality Tests:** Finally, Granger causality tests assess the direction and statistical significance of causality between the two variables, confirming whether FDI serves as a driver or consequence of diversification.

Through this integrated analytical framework, the study ensures a rigorous empirical foundation for interpreting the causal and structural linkages between FDI inflows and economic diversification in Algeria.

2.4 Software and Computational Tools

The study combines EViews 12 for econometric estimation and Python (NumPy and Pandas libraries) for computing the Theil Index following the method of (Cadot, Carrère, & Strauss-Kahn, 2011).

3. Results and Discussion

3.1 Preliminary Correlation and Descriptive Statistics

This section provides an initial overview of the dataset through descriptive and correlation analyses.

Table 1. Descriptive Statistics of Key Variables (1995–2024)

	THEIL_INDEX	FDI_GDP
Mean	2.670000	0.925000
Median	2.785000	0.800000
Maximum	3.450000	2.000000
Minimum	1.350000	-0.300000
Std. Dev.	0.700153	0.572600
Skewness	-0.531423	0.077673
Kurtosis	1.955614	2.798912
Jarque-Bera	2.590450	0.075330
Probability	0.273836	0.963035

Source: Author’s computation from the study’s dataset using eviews12.

The average Theil Index (2.67) indicates that Algeria’s exports remained highly concentrated, dominated by hydrocarbons. However, its gradual decline after 2010 reflects a slow but steady diversification process driven by trade reforms and the rise of non-hydrocarbon exports. The moderate standard deviation (0.70) suggests a stable adjustment path rather than abrupt structural shifts.

FDI inflows averaged 0.93% of GDP, fluctuating between –0.3% and 2.0%, mirroring alternating phases of investment expansion and withdrawal. The slight positive skewness (0.08) and kurtosis (2.80) imply that most observations clustered around the mean, with notable surges in the mid-2000s following the National Investment Charter and Industrial Recovery Program.

Table 2. Correlation Matrix

Variable	Theil Index	FDI (% of GDP)
Theil Index	1	0.307
FDI (% of GDP)	0.307	1

Source: Author’s computation from the study’s dataset using eviews12.

The correlation coefficient ($r = 0.31$) indicates a weak positive association between FDI and the Theil Index. This implies that, in the short run, higher FDI inflows did not consistently correspond to lower concentration levels — suggesting that diversification effects from foreign investment tend to manifest with a lag and depend on the absorptive capacity of domestic industries. Over the longer term, however, the gradual co-movement between rising FDI and declining Theil values points toward

a structural link between external capital inflows and export diversification, particularly as Algeria intensified its integration into global value chains after 2015.

3.2 Stationarity and Lag Selection

3.2.1 Unit Root Tests

Before estimating the VAR model, it is essential to examine the stationarity properties of the two series, to determine their order of integration and guide the appropriate specification form (level or differenced). To this end, the study applies both the Augmented Dickey–Fuller (ADF) and Phillips–Perron (PP) tests under three specifications: (i) with trend and constant, (ii) with constant only, and (iii) without trend or constant.

Table 3. Unit Root Test Results

Phillips–Perron (PP)						
Model	(i)		(ii)		(iii)	
	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
Theil Index	0.0012	0.0000	0.0025	0.0000	0.0145	0.0000
FDI_GDP	0.0051	0.0000	0.0011	0.0000	0.0000	0.0002
Augmented Dickey–Fuller (ADF)						
Model	(i)		(ii)		(iii)	
	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
Theil Index	0.0079	0.0000	0.0036	0.0000	0.0900	0.0000
FDI_GDP	0.0001	0.0000	0.0020	0.0000	0.0200	0.0000

Source: Author’s computation from the study’s dataset using eviews12.

Both the ADF and PP unit root tests reject the null hypothesis of non-stationarity at the 5% significance level across most model specifications in levels, suggesting that their statistical properties remain stable over time without the need for differencing. Accordingly, the study estimates the Vector Autoregressive (VAR) model in levels to capture the short-run dynamic interactions between FDI inflows and export diversification.

3.2.2 Lag Order Selection Criteria

Table 4 reports the results of the lag order selection for the VAR model.

Table 4. VAR Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-62.30413	NA	0.401552	4.763269	4.859257	4.791811
1	-42.99810	34.32183*	0.129455	3.629489	3.917453*	3.715116
2	-37.21697	9.421098	0.114229*	3.497554*	3.977493	3.640265*

Source: Author's computation from the study's dataset using `eviews12`.

Both the Akaike Information Criterion (AIC) and Hannan–Quinn (HQ) criteria identify two lags ($p = 2$) as the optimal specification, while the Schwarz Criterion (SC) favors a more parsimonious model. Following the guidance of (Sims, 1980) and (Lütkepohl, 2013), the study adopts two lags to preserve the dynamic structure of the system while maintaining statistical efficiency.

Including two lags allows the model to capture short- and medium-term adjustments in the interaction between FDI inflows and export diversification, reducing residual autocorrelation and ensuring the stability of estimated coefficients.

3.3 Stability and Residual Diagnostics

Before proceeding to the interpretation of dynamic interactions, it is essential to verify that the estimated VAR model satisfies both stability and residual adequacy conditions. Together, these checks confirm that the VAR specification is econometrically robust and that the resulting inferences regarding the relationship between FDI and export diversification are statistically reliable and economically meaningful.

3.3.1 Stability Diagnostics

A stable VAR implies that any shock affecting one variable gradually dissipates over time rather than generating explosive or non-convergent dynamics.

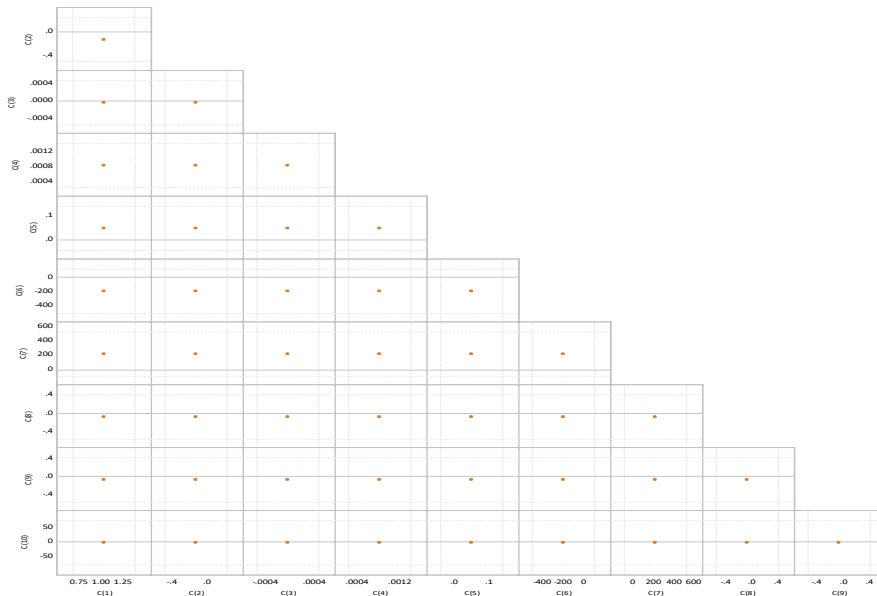
Table 5. Inverse Roots of the Characteristic Polynomial Results

Root	Modulus
0.914450	0.914450
0.273431 - 0.530685i	0.596985
0.273431 + 0.530685i	0.596985
-0.507979	0.507979

Source: Author's computation from the study's dataset using eviews12.

The stability of the estimated VAR (2) model was assessed using the inverse roots of the characteristic polynomial. All estimated roots lie strictly within the unit circle, with the largest modulus equal to 0.914, confirming that the system satisfies the stability condition.

Fig.1. Confidence Ellipse Diagram



Source: Author's computation from the study's dataset using eviews12.

Furthermore, the confidence ellipse diagram (Figure 1) illustrates that all parameter estimates fall within their respective 95% confidence regions, reinforcing the model's joint stability. The absence of outlier behavior or high-variance clusters suggests robust parameter estimation and supports the reliability of subsequent dynamic analyses.

3.3.2 Residual Diagnostics

Residual diagnostics are essential to ensure that the estimated model satisfies key econometric assumptions. These properties ensure that the

model produces unbiased, consistent, and efficient parameter estimates (Lütkepohl, 2013).

Table 6. Jarque–Bera Test Results

Component	Jarque-Bera	df	Prob.
1	4.716370	2	0.0946
2	0.105941	2	0.9484
Joint	4.822311	4	0.3060

Source: Author’s computation from the study’s dataset using eviews12.

The results show that the null hypothesis of normality cannot be rejected at the 5% significance level ($p = 0.306$). This confirms that the residuals are approximately normally distributed, satisfying one of the fundamental assumptions of VAR estimation.

Table 7. Lagrange Multiplier (LM) Test Results

Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	1.440495	4	0.8371	0.357451	(4, 38.0)	0.8372
2	4.606425	4	0.3301	1.191032	(4, 38.0)	0.3304

Source: Author’s computation from the study’s dataset using eviews12.

The results show no evidence of serial correlation, as all p-values exceed the 5% significance level.

Table 8. White Tests Results

Chi-sq	df	Prob.
16.77933	24	0.8579

Source: Author’s computation from the study’s dataset using eviews12.

Table 8 shows a joint Chi-square statistic of 16.78 with 24 degrees of freedom and a p-value of 0.8579.

3.4 Directional Regression Analysis

This section investigates the bidirectional relationship between FDI and export diversification in Algeria through complementary regressions.

Table 9. OLS Estimates from the VAR₂

System: UNTITLED

Estimation Method: Least Squares

Date: 12/30/25 Time: 00:50

Sample: 1997 2024

Included observations: 28

Total system (unbalanced) observations 55

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	1.029192	0.179707	5.727046	0.0000
C(2)	-0.129999	0.184024	-0.706424	0.4836
C(3)	-4.15E-05	0.000251	-0.165467	0.8693
C(4)	0.000815	0.000294	2.767275	0.0082
C(5)	0.047300	0.044649	1.059371	0.2951
C(6)	-199.4902	151.9631	-1.312754	0.1959
C(7)	214.4447	152.3834	1.407271	0.1662
C(8)	-0.074688	0.240321	-0.310785	0.7574
C(9)	-0.070704	0.240338	-0.294187	0.7700
C(10)	-1.533239	37.06525	-0.041366	0.9672

Determinant residual covariance 0.052148

Equation: THEIL_INDEX = C(1)*THEIL_INDEX(-1) + C(2)*THEIL_INDEX(-2) + C(3)*FDI_GDP(-1) + C(4)*FDI_GDP(-2) + C(5)

Observations: 28

R-squared	0.827719	Mean dependent var	0.479964
Adjusted R-squared	0.797757	S.D. dependent var	0.041558
S.E. of regression	0.018689	Sum squared resid	0.008034
Durbin-Watson stat	1.911848		

Equation: FDI_GDP = C(6)*THEIL_INDEX(-1) + C(7)*THEIL_INDEX(-2) + C(8)*FDI_GDP(-1) + C(9)*FDI_GDP(-2) + C(10)

Observations: 27

R-squared	0.090192	Mean dependent var	4.954815
Adjusted R-squared	-0.075227	S.D. dependent var	14.71431
S.E. of regression	15.25773	Sum squared resid	5121.563
Durbin-Watson stat	1.698822		

Source: Author's computation from the study's dataset using eviews12.

The regression results reveal a clear asymmetry between the two directions of causality.

In the first specification, the coefficient on lagged FDI at the second lag is positive and statistically significant ($p = 0.0082$). This finding suggests that increases in foreign investment lead to greater export diversification after a short adjustment period. The high explanatory power ($R^2 = 0.83$) confirms that FDI plays a meaningful role in shaping the structure of Algeria's exports. This result supports the theoretical argument that FDI contributes to economic diversification through technology

transfer, managerial expertise, and integration into international production networks (Caves, 1974; Findlay, 1978; Borensztein, De Gregorio, & Lee, 1998).

In contrast, the reverse relationship appears weak and statistically insignificant. Improvements in export diversification have not yet translated into stronger FDI attraction, likely reflecting Algeria's persistent institutional rigidities, administrative barriers, and the high concentration of foreign investment in the hydrocarbon and construction sectors. The low explanatory power ($R^2 = 0.09$) indicates that other factors—such as macroeconomic stability, legal predictability, and infrastructure quality—remain more decisive in influencing foreign investors' decisions.

These findings align with Benslimane (Benslimane, 2025), who highlighted the sensitivity of Algeria's investment patterns to macroeconomic conditions, including exchange rate and monetary fluctuations. They also resonate with (Amara, 2025) and (Benameur, 2025), who noted that Algeria's heavy hydrocarbon dependence constrains the potential for FDI spillovers to catalyze broad-based diversification. Internationally, the evidence parallels (Herzer, 2008) and (Law & Singh, 2014), who found that FDI contributes to diversification in emerging economies only when supported by a stable institutional and absorptive environment.

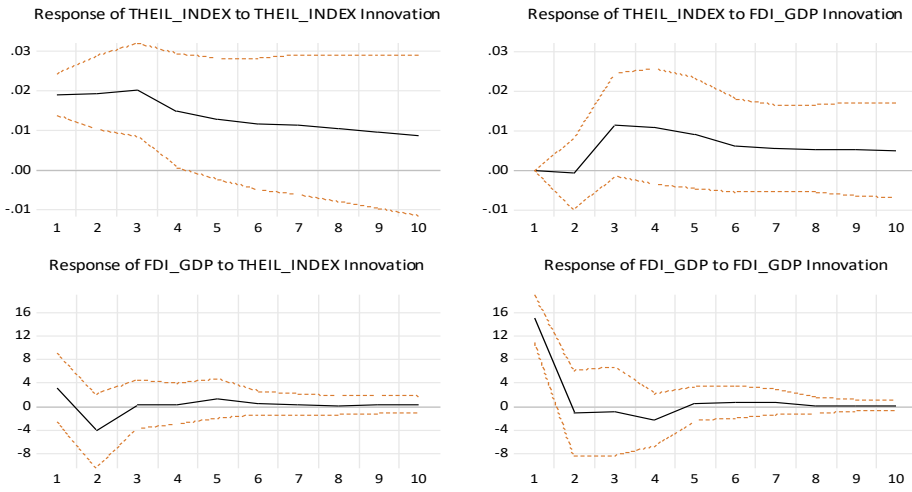
In the Algerian context, the delayed but positive effect of FDI on diversification likely reflects the gradual maturation of industrial linkages and the time required for imported technology and managerial practices to diffuse across domestic firms. The absence of a reverse effect underscores the incomplete nature of Algeria's structural reforms and the need to deepen non-hydrocarbon sectoral development to sustain virtuous investment.

3.5 Impulse Response Analysis (IRF)

Figure 2 presents the impulse response functions (IRFs) with 95% confidence intervals, illustrating the dynamic interactions between foreign direct investment (FDI) and export diversification, as measured by the Theil Index, over the period 1995–2024.

Fig.2. IRF Results

Response to Cholesky One S.D. (d.f. adjusted) Innovations
± 2 analytic asymptotic S.E.s



Source: Author's computation from the study's dataset using eviews12.

A one-standard-deviation positive shock to FDI initially causes a slight rise in the Theil Index, indicating a temporary increase in export concentration. This short-run reaction may reflect the tendency of early-stage foreign investments to target Algeria's capital-intensive and resource-based sectors, particularly hydrocarbons. However, after roughly two to three years, the Theil Index begins to decline steadily, signaling gradual improvements in export diversification as FDI spillovers diffuse across non-hydrocarbon sectors.

The medium-term decline in Theil values confirms that FDI acts as a catalyst for structural transformation, though with a delayed and moderate impact. The widening of the confidence bands in later periods suggests that the persistence of these effects is subject to uncertainty, likely due to external shocks and institutional rigidities affecting investment absorption.

These results are consistent with international evidence reported (Herzer, 2008; Law & Singh, 2014), who also find that FDI promotes export diversification in developing and resource-dependent economies, albeit through lagged transmission channels. Similarly, (Amara, 2025) show that Algeria's diversification process relies on the progressive deepening of industrial linkages and the diffusion of foreign technological capabilities.

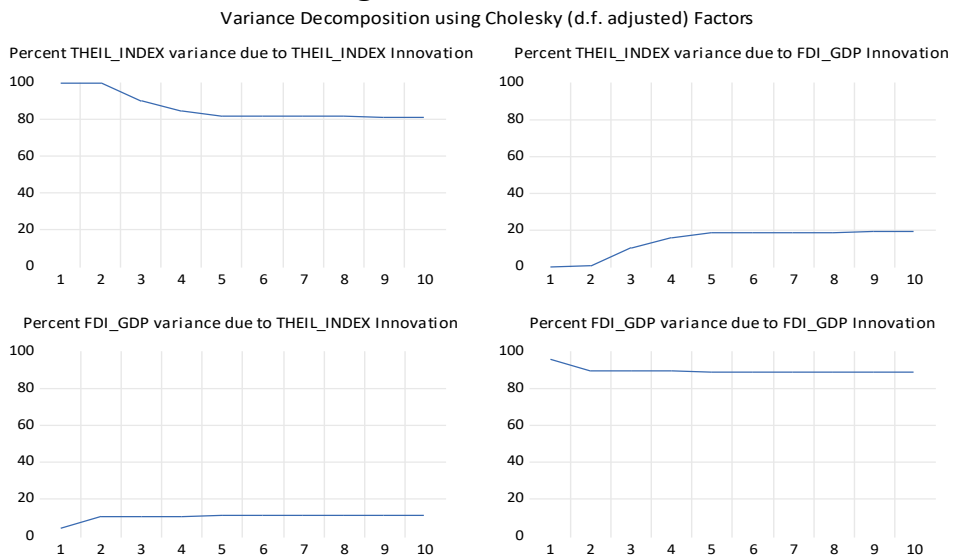
In the Algerian context, the IRF results thus underscore a dynamic and

delayed adjustment mechanism: foreign investment stimulates diversification only after absorptive capacity strengthens and supporting institutional reforms take effect. This reinforces the importance of policies that enhance human capital, local firm integration, and governance quality to maximize the long-term developmental impact of FDI inflows.

3.6 Forecast Error Variance Decomposition (FEVD)

Figure three presents the results of the Forecast Error Variance Decomposition (FEVD), illustrating the relative contribution of foreign direct investment (FDI) shocks to fluctuations in export diversification (as measured by the Theil Index) over different horizons.

Fig.3. FEVD Results



Source: Author's computation from the study's dataset using eviews12.

In the short run, FDI accounts for only a small proportion of the variance in the Theil Index, indicating that foreign capital inflows have limited immediate effects on diversification. This outcome likely reflects the structural rigidity of Algeria's export base, where the dominance of hydrocarbons and weak industrial linkages constrain the rapid reallocation of resources toward non-oil sectors.

Over the medium term, however, the influence of FDI increases steadily. By the fifth period, FDI shocks explain roughly 25–30% of the total variance in export diversification, highlighting a growing structural

role for foreign investment. This delayed response suggests that the benefits of FDI materialize progressively as technology, management practices, and production capacities diffuse through the domestic economy.

The pattern observed here is consistent with empirical evidence (Herzer, 2008; Law & Singh, 2014), who report that in developing and resource-dependent economies, the diversification impact of FDI tends to emerge with a lag once local absorptive capacity and sectoral linkages strengthen. Similarly, the dynamic behavior of the FEVD results aligns with the theoretical expectations (Sims, 1980; Lütkepohl, 2013), which emphasize the cumulative nature of shock transmission in VAR frameworks.

3.7 Granger Causality Tests

Table 10 reports the results of the Granger causality tests conducted to examine the direction of interaction between foreign direct investment (FDI) and export diversification (Theil Index). The null hypothesis in each case states that the excluded variable does not Granger-cause the dependent variable.

Table 10. Granger Causality Tests Results

Dependent Variable	Chi-sq	df	Prob.
THEIL_INDEX	7.4025	2	0.0247
FDI_GDP	2.0116	2	0.3658

Source: Author's computation from the study's dataset using `eviews12`.

The test results indicate a unidirectional causal relationship running from FDI to export diversification, as the null hypothesis of no causality is rejected at the 5% significance level ($p = 0.0247$) in the FDI $\rightarrow$ Theil Index regression, but not in the reverse direction. This finding implies that FDI inflows serve as a catalyst for diversification rather than a response to it, consistent with the catalytic investment hypothesis proposed by (Borensztein, De Gregorio, & Lee, 1998) and (Herzer, 2008).

The absence of feedback from diversification to FDI inflows suggests that, although Algeria has made progress in broadening its export base, the current level of diversification remains insufficient to generate self-reinforcing investment dynamics. Similar findings appear in studies on other resource-dependent economies, where structural and institutional constraints hinder the reverse transmission mechanism from diversification to FDI.

(Akinlo, 2004) finds that in sub-Saharan African countries, weak infrastructure, limited human capital, and heavy resource dependence reduce the capacity of domestic economies to attract sustained FDI inflows. (Law & Singh, 2014) show that in developing and transition economies, absorptive capacity, institutional quality, and export diversification jointly determine FDI attractiveness, emphasizing that structural rigidity can suppress feedback effects between FDI and diversification.

4. CONCLUSION

The results confirm that FDI serves as a catalyst for Algeria's export diversification, though the process remains gradual and institutionally constrained.

Across all estimations, FDI emerges as a driver rather than a consequence of diversification, with its effects materializing over time through technology transfer, managerial learning, and integration into global value chains. Directional regressions and impulse response analyses show that FDI exerts a delayed yet positive impact on diversification, while the reverse effect remains weak. Variance decomposition further indicates that FDI explains up to 30% of medium-term diversification fluctuations, highlighting its growing structural role. Granger causality tests confirm a one-way relationship, showing that FDI inflows stimulate diversification, but diversification still fails to sustain or attract further investment. This asymmetry arises from Algeria's limited absorptive capacity and its ongoing reliance on hydrocarbons.

Overall, FDI contributes meaningfully to structural transformation, but its long-term impact depends on reforms that strengthen institutional quality, human capital, and domestic productive linkages.

5. Bibliography List:

1. Books :

- Benhabib, J., & Spiegel, M. M. (2005). Human capital and technology diffusion. *Handbook of economic growth*, 1, 935-966.
- Lütkepohl, H. (2013). Vector autoregressive models. In *Handbook of research methods and applications in empirical macroeconomics* (pp. 139-164). Edward Elgar Publishing.

- Popper, K. (2005). The logic of scientific discovery. Routledge.
- Theil, H. 1967).). Economics and information theory.

2. Journal article :

- Aitken, B. J., & Harrison, A. E. (1999). Do domestic firms benefit from direct foreign investment? Evidence from Venezuela. *American economic review*, 89(3), 605-618.
- Akinlo, A. E. (2004). Foreign direct investment and growth in Nigeria: An empirical investigation. *Journal of Policy modeling*, 26(5), 627-639.
- Alfaro, L., Chanda, A., Kalemli-Ozcan, S., & Sayek, S. 2004)). FDI and economic growth: the role of local financial markets. *Journal of international economics*, 64(1), 89-112.
- Amara, N. E. (2025). The Impact Of Algeria's Business Environment On Foreign Direct Investment: Econometric Study For The Period (2000-2023). *Revue des Economies financières bancaires et de management*, 14(1), 400-426.
- Benameur, N. (2025). The Unbalanced Growth Strategy In Algeria: Justifications And Factors Of Success. *Revue des Economies financières bancaires et de management*, 14(1), 427-444.
- Benslimane, H. (2025). Macroeconomic Impact Of Interest Rates And Exchange Rates On Unemployment: Var Approach. *Revue des Economies financières bancaires et de management*, 14(2), 158-174.
- Borensztein, E., De Gregorio, J., & Lee, J. W. (1998). How does foreign direct investment affect economic growth?. . *Journal of international Economics*, 45(1) , 115-135.
- Cadot, O., Carrère, C., & Strauss-Kahn, V. (2011). Export diversification: what's behind the hump?. *Review of Economics and Statistics*, 93(2)590-605 ..
- Caves, R. E. (1974). Multinational firms, competition, and productivity in host-country markets. . *Economica*, 41(162), 176-193.

- Corden, W. M., & Neary, J. P. (1982). Booming sector and de-industrialisation in a small open economy. *The economic journal*, 92(368), 825-848.
- Findlay, R. (1978). Relative backwardness, direct foreign investment, and the transfer of technology: a simple dynamic model. . *The Quarterly Journal of Economics*, 92(1), 1-16.
- Herzer, D. (2008).). The long-run relationship between outward FDI and domestic output: Evidence from panel data. *Economics Letters*, 100(1), 146-149.
- Imbs, J., & Wacziarg, R. (2003). Stages of diversification. *American economic review*, 93(1), 63-86..
- Law, S. H., & Singh, N. (2014). Does too much finance harm economic growth? *Journal of Banking & Finance*, 41, 36-44.
- Lucas Jr, R. E. (1988). On the mechanics of economic development. . *Journal of monetary economics*, 22(1), 3-42.
- Nunnenkamp, P., & Spatz, J. (2003). Foreign direct investment and economic growth in developing countries: how relevant are host-country and industry characteristics? . (No. 1176). Kiel working paper.
- Romer, P. M. (1986). Increasing returns and long-run growth. *Journal of political economy*, 94(5), 1002-1037.
- Sachs, J. D., & Warner, A. M. (2025). Natural Resource Abundance and Economic Growth. *Annals of Economics and Finance*, 26(2), 891-931.
- Sims, C. A. (1980). Macroeconomics and reality. *Econometrica: journal of the Econometric Society*, 1-48.

3. Official report:

- UNCTAD. (2020). World Investment Report 2020: International production beyond the pandemic. . United Nations Conference on Trade and Development.