

An Econometric Study of the Dynamics of Modern Economic Growth in Algeria over the Period (1990–2023)

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Abstract: The study aimed to investigate the relationship and impact between modern economic growth and its determinants in Algeria over the period 1990–2023, using the Autoregressive Distributed Lag (ARDL) model. The econometric model was estimated after testing the stationarity of the time series and verifying the existence of a long-run cointegration relationship. The results revealed the presence of a long-run equilibrium relationship, as well as a statistically significant positive effect of gross capital formation, mean years of schooling, trade openness, foreign direct investment, and carbon dioxide (CO₂) emissions on gross domestic product (GDP). Conversely, renewable energy consumption exhibited a statistically significant negative effect on GDP.

Keywords: Modern economic growth; determinants of growth; Stability Tests; ARDL Model.

1. Introduction

Economic growth has evolved as a field of study and has witnessed numerous contributions, ideas, and theories aimed at understanding its driving forces and the mechanisms for sustaining it, as it is regarded as a key indicator of economic progress and development. The discussion of economic growth dates back to the ideas put forward by Adam Smith, who attributed the wealth of nations to specialization, the division of labor, and the expansion of market size. This was followed by classical and neoclassical models that emphasized the accumulation of physical capital and labor. Over time, economic growth theory has undergone rapid and successive development, as modern analysis has moved beyond the narrow traditional perspective to focus on a broader set of determinants that reflect the complexities of the global economy and the pressing requirements of sustainable development.

Economic thought regarding the determinants of growth has undergone substantial evolution. Classical and neoclassical frameworks—including the Harrod–Domar model and the Solow growth model—posited capital accumulation as the principal driver of economic growth. The contributions of economists such as G. D. Haberler and Anne Krueger, building on earlier insights by David Ricardo through the theory of comparative advantage, underscore how integration into the global economy enhances resource allocation efficiency

and facilitates technology diffusion.

Subsequently, endogenous growth theories advanced by scholars such as Paul Romer and Robert Lucas shifted the analytical focus toward knowledge creation and human capital accumulation, emphasizing their role in generating increasing returns and sustaining long-run economic growth. More recently, the challenges of the twenty-first century have brought environmental sustainability to the forefront of growth analysis. Drawing on the seminal work of the Club of Rome in the 1970s and the Brundtland Report, which formally articulated the concept of sustainable development; contemporary growth models increasingly incorporate environmental indicators. Consequently, variables such as renewable energy consumption and carbon emissions have become integral determinants that are inseparable from modern growth frameworks.

Developing countries in general and Algeria in particular, suffer from excessive dependence on a single sector as the main source of income. Oil, as a non-renewable economic resource, constitutes a substantial share of national income and has played a pivotal role in shaping and financing development plans—particularly during periods of high oil prices, notably between 2000 and 2014. Understanding the effects of oil price fluctuations on economic growth rates has therefore become a critical necessity for outlooks, especially under current global conditions. This necessitates the formulation of appropriate policies and measures aimed at restructuring revenue sources in order to mitigate the crises arising from oil price volatility.

Moreover, there is an increasing need to transition away from growth models predominantly driven by government spending financed by oil revenues toward a modern growth paradigm that promotes sustainable economic growth and job creation through the diversification of economic activities beyond the hydrocarbon sector. This transition further requires strengthening the role of the private sector in economic activity by providing a conducive environment for investment.

1.1. Research Problem:

Accordingly, this study seeks to address the following research question: What are the key determinants of modern economic growth in Algeria during the period 1990-2023?

1.2. Research Hypotheses:

In order to address the research problem under investigation, a set of subsidiary hypotheses was formulated, including the following:

1. How does human capital accumulation, including education and skills development, contribute to modern economic growth in Algeria, both in the short and long run?
2. How do physical capital accumulation and investment in infrastructure contribute to the growth of the Algerian economy, with measurable effects in both the short and long run?
3. How does economic diversification and the development of non-hydrocarbon sectors contribute to enhancing economic growth in Algeria, thereby mitigating the effects of oil price volatility in both the short and long run?

1.3. Research Objectives:

The study aims to analyze and measure the determinants of modern economic growth in Algeria within the framework of contemporary economic growth models over the period 1990–2023, using the Autoregressive Distributed Lag (ARDL) model. Accordingly, the objectives of the study are as follows:

- To highlight the relationship between the economic growth rate and human capital.
- To examine the impact of sustainable development indicators on the economic growth rate in Algeria.
- To study the effect of foreign direct investment on the growth rate of the Algerian

economy.

1.4. Research Methodology:

The study's objectives and hypotheses can be addressed using a combination of methodologies. The descriptive approach is employed to present the theoretical foundations of economic thought regarding the concept and measurement indicators of modern economic growth, in addition to reviewing the literature on the determinants of modern economic growth necessary for constructing growth models for the Algerian economy. The analytical approach is applied to develop an econometric model for estimating the growth function within a contemporary economic framework in Algeria over the period 1990–2023, using the Autoregressive Distributed Lag (ARDL) model.

1.5. Previous Studies:

-Study by Ozlem Ulger Danaci (2025), “The Impact of Renewable and Non-Renewable Energy on Economic Growth: A Cointegration Analysis of the Major Renewable Energy Consumers (1970–2023)”. The relationship between renewable and non-renewable energy and economic growth plays a fundamental role in sustainable development. However, studies on this relationship in countries with the highest renewable energy consumption remain limited. This study analyzes the effects of renewable and non-renewable energy on economic growth over the period 1970–2023, focusing on the ten leading countries in renewable energy consumption. These countries form an appropriate sample for analysis, not only due to their high renewable energy utilization but also because they represent diverse levels of economic development. To this end, second-generation panel data techniques were employed to investigate long-term effects while accounting for cross-sectional dependence and heterogeneity within the dataset. The Pesaran-developed CADF unit root test indicated that all variables are stationary at first differences. Westerlund's cointegration test confirmed the existence of a long-term relationship among the variables (Ülger, 2025).

-Study by Basirat Esan and Abubakar Hassan (2020), “The Relationship between Carbon Dioxide Emissions, Energy Consumption, and Economic Growth in Nigeria”. This study examined the relationship between carbon dioxide emissions, energy consumption, and economic growth in Nigeria over the period 1980–2016. Secondary data were collected from various semi-governmental energy databases and analyzed using Granger causality (Wald test) and Vector Autoregression (VAR), with further focus on impulse response functions and variance decomposition analysis. The study found that GDP is associated with an increase in carbon emissions in the Nigerian context, while primary energy consumption and emissions are positively related. This positive relationship aligns with theoretical expectations, due to the large surplus in supply and the relatively lower excess demand in primary energy consumption in Nigeria (Basirat & Hassan, 2020).

-Study by Ali Wahib Abdullah Saleh (2016), “The Impact of Oil Price Fluctuations on Economic Growth Rates in Iraq (1990–2013)”. This study investigated the relationship between oil price fluctuations and economic growth rates in Iraq over the period 1990–2013. The findings indicate that oil prices and gross capital formation have a significant impact on Iraq's GDP, with the oil sector constituting one of the most important components of the country's gross domestic product (Salih, 2016).

-Study by Charles Kindleberger (2007) on the European economy for the period 1963–1959. The study found that the rapid growth of the labor force was one of the key drivers of accelerated economic growth, as observed in Germany after World War II, which experienced significant inflows of population from East Germany and Mediterranean countries in the post-war period. A similar pattern was observed in Italy. However, Germany possessed strong domestic technological capabilities that were effectively employed during the post-war reconstruction phase, with technology contributing approximately 90% to its economic growth until the late 1950s (Al-Tikriti, 2009).

-Study by Omran (2002) on the performance and sources of economic growth in the

Egyptian economy. This study examined two periods, 1960–2000 and 1975–2000, aiming to identify the sources of economic growth in Egypt. The results indicated a statistically significant effect of foreign direct investment (FDI) on total factor productivity; however, the relationship was negative, which contradicts theoretical expectations. This was explained by the nature and quality of these investments during the period, as a portion of FDI was directed toward newly privatized firms, with most concentrated in consumer projects and assembly industries rather than in actual manufacturing and production processes. Consequently, these investments did not lead to the adoption of modern technologies that could enhance productivity efficiency. It can be concluded that the issue was not the inflow of FDI itself, but rather its type, utilization, and alignment with objectives that effectively support economic growth (Omran, 2002).

- **Study by Sala-i-Martin (1997).** This study identified a wide range of variables affecting economic growth rates. Among these factors were political variables, such as government effectiveness, rule of law, and property rights protection, as well as variables related to investment growth, the extent of reliance on raw materials in exports, the degree of economic openness, and the educational level of the population. Additionally, the study considered the importance of relative macroeconomic stability, including inflation rates, exchange rate volatility, and budget deficits (Sala-i-Martin, 1997)

- **Study by Robert J. Barro (1991).** Barro analyzed the determinants of economic growth across 100 countries and found several variables with significant long-term effects on growth rates, including the level of education, investment share, political stability, and initial income levels (Barro, 1991).

- **Study by Robert Solow (1968)** on the aggregate growth of agricultural output in the United States during the period 1900–1960. Solow found that only 10% of this growth could be attributed to three factors: capital, labor, and the increase in conventional sources of wealth, while the remaining 90% was due to factors encompassed under the category of technological progress (Darwish, 1968).

2.Theoretical Framework

2.1 The Concept of Economic Growth and Its Indicators:

The topic of economic growth has attracted the attention of numerous economists, from classical theorists to contemporary scholars, who have sought to analyze the concept, develop explanatory models, and identify the most effective policies to support it in light of the realities of the new global economic environment.

2.1.1 The Concept of Economic Growth:

Economic growth represents a primary objective of economic policy in all countries, regardless of their economic system, as it reflects the material outcome of both economic and non-economic efforts exerted within society. It enables the state to perform essential functions such as social welfare, education, and healthcare more effectively. Economic growth is a necessary, though not sufficient, condition for improving individuals' living standards; the sufficient condition is the equitable distribution of the achieved growth.

Accordingly, economic growth can be viewed as the value added produced by society, typically measured by changes in gross domestic product (GDP). It can thus be defined as “the annual real increase in national output, representing the growth in the quantity of goods and services produced by the economy in a given year” (Arrous, 1999). In addition, economic growth can be understood as the long-term increase in a country's capacity to supply a diverse range of economic goods to its population, with productivity gains relying on technological progress and necessary institutional or ideological adjustments (Zaqrir, 2015). From another perspective, Simon Kuznets defined economic growth as “a long-term rise in the capacity to provide an increasingly diverse set of economic goods to the population, with this expanding capacity depending on advanced technology, institutional

adaptation, and ideological adjustments”. From this definition, several characteristics or features of economic growth can be identified:

- Focus on long-term growth, emphasizing sustainable growth rather than transient fluctuations.
- The role of technology in driving long-term economic expansion.
- The necessity of institutional and ideological adaptation, highlighting the importance of a robust institutional framework in the growth process.
- Bridging the gap between economic growth as a spontaneous process and economic development as a deliberate action, indicating that sustainable economic growth results from policies, institutions, and structural changes.

Sustainable economic growth is closely linked to fundamental societal factors, such as good governance, efficient institutions, research and development, education, and health. Consequently, achieving a sustainable economic growth rate reflects the overall development process, with human capital being the primary driver of this growth (Nasr, 2005).

2.1.2 Indicators of Economic Growth:

Economists rely on a set of economic indicators to measure and express economic growth, among which the most important are:

- Real Gross Domestic Product (GDP): This represents the value of final goods and services produced within a country’s geographical boundaries during a specific period (usually one year), after excluding the value added by all units operating in different production sectors of the economy.
- Real GDP per capita: Although the evolution of GDP per capita may not fully reflect the ultimate goal of development, which is to improve individual living standards, the development literature has considered this indicator as a measure of growth. Economic growth, in this context, implies a continuous increase in real GDP per capita over time.
- Foreign trade indicators: Foreign trade is generally viewed as a driver of growth, serving as a source of financing necessary for the growth process and as a major provider of intermediate and productive goods. It also influences, and is influenced by, the structure of economic activity, depending on the nature of international trade relations and the resulting exchange rate fluctuations. Exports and imports play a role in determining the local currency’s exchange rate, thereby affecting the balance of payments. Consequently, foreign trade indicators are considered important and representative measures of economic growth (Salih, 2016).

2.2. Sources of Economic Growth: Literature Review:

Understanding the sources of economic growth has been one of the most debated topics in recent decades. The focus on long-term growth attracted significant attention from economists during the 1950s. It is noteworthy that many of the currently prevailing growth theories are strongly linked to the classical theories developed during that period, particularly the (Solow, 1956) and (Swan, 1956) models, which serve as the foundation for most modern economic growth theories, studies, and research.

2.2.1. The Modern Classical Theory of Economic Growth:

According to this theory, the basic components of the production process consist of three elements:

- Capital (K): This refers to all tangible inputs such as machinery, land, buildings, and other capital goods. Capital represents the physical resources used in production.
- Labor (L): Labor represents the workforce contributing to the production process. Productivity varies across individuals depending on their skills; thus, enhancing labor

productivity can be achieved through investment in human capital. This investment takes several forms, primarily education and health.

- **Technology (A):** Technology represents the knowledge or techniques applied alongside capital and labor to produce outputs. In practice, technology, often captured in the concept of total factor productivity (TFP), encompasses many elements that are not fully observable. Key determinants include investment in human capital, the degree of economic openness, foreign direct investment, macroeconomic variables, and government quality.

Since these three elements constitute the primary inputs, the outputs correspond to the goods and services produced by society. Accordingly, the production function for a given economy under these assumptions can be expressed by the following implicit production function:

$$Y = F(K, L) \quad \dots \dots \dots (1)$$

Where:

Y: Total output in the economy, **K:** Capital, **L:** Labor

One of the most well-known examples of production functions under the modern classical theory is the Cobb–Douglas production function, which is generally expressed as follows:

Where:

$$Y = A \cdot K^\alpha \cdot L^\beta \quad \dots \dots \dots (2)$$

- **A:** A constant representing the prevailing level of knowledge or technology in the economy, commonly referred to as Total Factor Productivity (TFP).

- **α :** The output elasticity of capital, indicating the relative contribution of capital to production.

- **β :** The output elasticity of labor, indicating the relative contribution of labor to production.

Under the modern classical theory, the production function represented by Equation (2) exhibits specific characteristics:

- **Constant returns to scale:** This implies that if both capital and labor are increased by a certain proportion, output is expected to increase by the same proportion.

- **Diminishing marginal returns:** The production function is subject to the law of diminishing marginal returns for both capital (K) and labor (L). For example, if one additional unit of capital is added without increasing labor, the effect on output depends on the initial stock of capital. If the initial capital stock is very low, the additional unit will have a relatively large impact on output. Conversely, if the initial capital stock is already sufficient or abundant, the impact of the additional unit on total output will be relatively small.

According to this equation, output in an economy can increase under three conditions: an increase in physical capital, an increase in labor, or an improvement in the technology employed. By taking the total differential of Equation (2) and dividing accordingly, we obtain:

$$\frac{\Delta Y}{Y} = \frac{\Delta A}{A} + \alpha \cdot \frac{\Delta K}{K} + \beta \cdot \frac{\Delta L}{L} \quad \dots \dots \dots (3)$$

$$\hat{Y} = \hat{A} + \alpha \hat{K} + \beta \hat{L} \quad \dots \dots \dots (4)$$

The modern classical theory emphasizes that an economy cannot achieve indefinite growth solely through increases in physical capital. In other words, sustainable long-term growth cannot be attained merely by raising the rate of physical investment. Initially, an increase in physical capital will boost GDP, but over the long term, this effect diminishes

and eventually disappears, in accordance with the law of diminishing marginal returns. The same principle applies to increases in labor when capital is held constant, as the law of diminishing marginal returns for labor will eventually take effect beyond a certain threshold.

2.2.2. The Modern Theory of Long-Term Economic Growth:

Although classical growth theory recognizes technological progress as one of the fundamental sources of sustainable growth, it does not explain how this progress translates into economic growth, assuming instead that technological advancement occurs at an exogenous and automatic rate. Ultimately, the classical theory fails to fully account for the ultimate source of sustainable growth.

Since the mid-1980s, economists have sought to identify the primary drivers of growth, giving rise to what is known as modern growth theories. These theories acknowledge multiple sources of growth and, while sharing similarities with classical theory, differ in several important aspects:

- **Human capital investment:** Modern growth theory posits that labor productivity can be enhanced through investment in human capital, primarily via education and skill development. This approach provides a way to overcome the diminishing marginal returns highlighted in classical theory by investing in both labor and capital simultaneously.
- **Technological progress through R&D:** The theory emphasizes that technological advancement can be increased through research and development, suggesting that sustainable long-term growth can be achieved by enhancing this factor alone.
- **The role of the state:** Modern growth theorists highlight the state's influence on economic growth by affecting overall factor productivity. The state is considered a central actor in the economy, for instance, by establishing a legal framework that protects individuals and institutions, ensuring justice, and enabling productive and service activities. Failure to provide such a system may discourage private actors from engaging in production, thereby reducing growth rates. Moreover, a stable political system encourages investment, which in turn stimulates economic growth (Omran, 2002).

2.2.3. The Environmental Kuznets Curve (EKC):

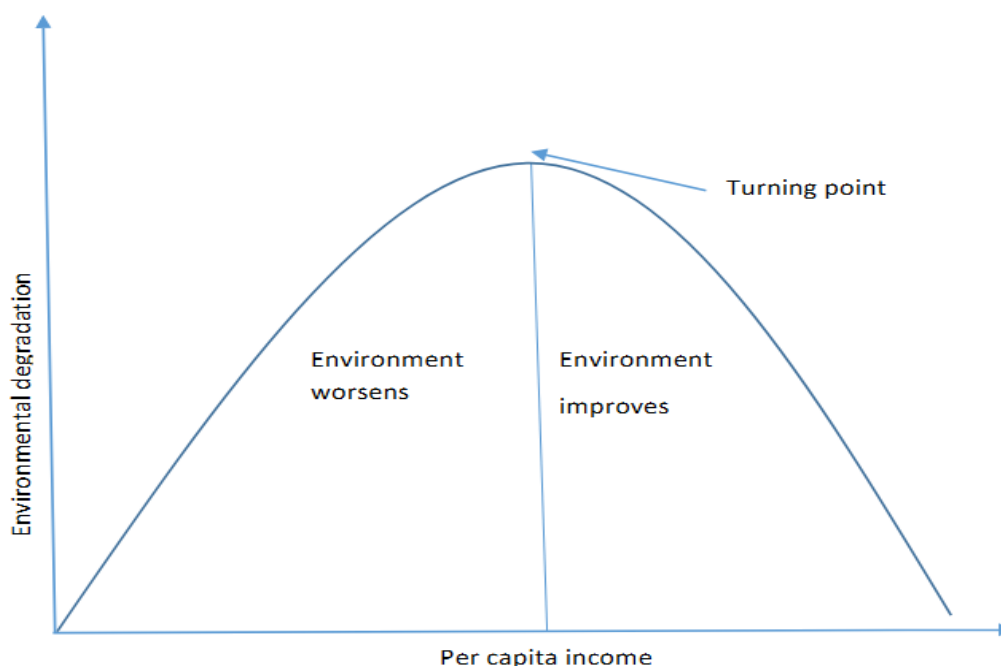
The changing relationship between income quality and per capita income, which can be observed empirically and theoretically using modern economic analysis tools, can be represented through the Kuznets Curve. The underlying idea of this theory is that income distribution is initially unequal at different stages of income growth. However, as the economy grows, income distribution tends to become more balanced. Simon Kuznets proposed a conceptual framework indicating that as per capita income increases, income inequality initially rises, reaching a maximum point, and then begins to decline. The question of achieving economic growth or sustainable development without altering the natural composition of the ecosystem and environmental quality is a matter of debate among natural, physical, and social scientists.

Economic growth requires larger amounts of capital, labor, and other resources, which subsequently generate greater quantities of environmental waste, such as gas emissions and effluents, rendering the environment increasingly unsuitable for human habitation. The Environmental Kuznets Curve (EKC) hypothesis posits an inverted U-shaped relationship between per capita income and environmental degradation. It assumes that in the early stages of economic growth and development, environmental degradation increases at an accelerating rate. However, after reaching a certain threshold of economic development, the trend tends to reverse at higher levels of economic progress.

To achieve higher levels of development, society must subsequently utilize natural resources in ways that may inadvertently have residual environmental impacts, thereby promoting long-term and sustainable development. Pollution tends to grow faster when priority is given to increasing material productivity along with output. This often leads to

public insensitivity, prioritizing financial gains over environmental quality. Consequently, rapid economic growth results in greater exploitation of natural resources, higher pollutant levels, and environmental degradation (Usenata, 2018).

Figure 1. The Environmental Kuznets Curve (EKC)



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Source: World Commission on Environment and Development. (1987). Our common future (p. 3). Oxford University Press.

2.2.4. The Theory of Sustainable Development (Development, 1987)

The concept of sustainable development traces its roots to the Brundtland Report published in 1987 by the World Commission on Environment and Development (WCED), titled *Our Common Future*. This report provided the first formal definition of sustainable development as development that meets the needs of the present without compromising the ability of future generations to meet their own needs. The report emphasizes the necessity of balancing the three dimensions of sustainability: economic, environmental, and social. Consequently, the utilization of renewable energy sources represents a direct application of the sustainability principle, as it reduces environmental pressure without sacrificing economic growth.

- Environmental Dimension in the Report:

The Brundtland Report emphasizes that uncontrolled economic growth since the Industrial Revolution has led to the depletion of natural resources, increased pollution levels, and climate changes that threaten ecological balance. Therefore, economic development cannot be separated from environmental protection, as environmental degradation undermines future productive capacities and, consequently, hinders development itself. The core principle is that “the environment is not an obstacle to development but a fundamental condition for its sustainability.”

- Renewable Energy in the Report:

The report dedicates an entire chapter titled “Energy: Choices for Environment and Development” to discuss the relationship between energy, growth, and the environment. It highlights that the world relies heavily on fossil fuels as a primary energy source, which leads to massive emissions of CO₂ and other greenhouse gases. Continued reliance on this pattern results in severe climate changes that threaten agricultural production and ecological balance.

Therefore, the report advocates for a transition to a new energy paradigm: renewable energy sources (solar, wind, hydro, and biomass), which are considered fundamental for achieving sustainable development because they:

- Are inexhaustible resources;
- Generate minimal emissions;
- Can be used locally in developing countries, reducing energy dependency.

3.Results and Discussion:

3.1 Estimating the Functional Relationship in a Dynamic Framework Using the ARDL Mode:

In light of previous studies conducted on this topic, the relationship within the modern growth model in Algeria over the period 1990–2023 is examined. The study variables were selected based on various modern growth theories. Gross Domestic Product (GDP) was used as the dependent variable, while the independent variables represented the modern determinants of economic growth, namely: Gross Fixed Capital Formation as a percentage of GDP, Trade Openness Rate, Foreign Direct Investment (FDI) as a percentage of GDP, Mean Years of Schooling, Renewable Energy Consumption, and Carbon Dioxide (CO₂) Emissions. The data were obtained from the World Bank database (WD) and the U.S. Energy Information Administration (EIA).

After examining the stationarity and cointegration of the series, the Autoregressive Distributed Lag (ARDL) model is employed, along with the Bound Test, to investigate cointegration and both long- and short-run relationships. The ARDL model is particularly suitable because it can be applied whether the variables under study are integrated of order zero, I(0), order one, I(1), or a combination of both.

To estimate the functional relationship and test for the existence of a long-run equilibrium relationship according to economic theory and previous studies, the following logarithmic model will be estimated:

$$LGDP=f(LINV, LOUV, LFDI, LSYM, LCR, LCO2)...(1)$$

Where:

- **LGDP:** Logarithm of Gross Domestic Product (GDP).
- **LINV:** Logarithm of Gross Fixed Capital Formation as a percentage of GDP.
- **LOUV:** Logarithm of Trade Openness.
- **LFDI:** Foreign Direct Investment (FDI) as a percentage of GDP.
- **LSYM:** Mean Years of Schooling.
- **LCR:** Logarithm of Renewable Energy Consumption in tons of oil equivalent.
- **LCO2:** Logarithm of Carbon Dioxide (CO₂) emissions in tons of oil equivalent.

To estimate the ARDL model, it is necessary to perform the required time series tests on the variables under study to determine whether they are stationary or non-stationary and to identify their order of integration. In addition, it is essential to verify the existence of a long-run equilibrium relationship among the time series of the variables used in the analysis, i.e., to establish whether cointegration exists between the variables.

3.2. Results of the Stationarity Test:

The purpose of the unit root test is to examine the properties of the time series for each study variable, verify the stationarity of the economic variables, and determine the order of integration for each variable.

To study the stationarity of each variable, the simplified methodology for unit root tests

presented in Appendix (1) was adopted. The same appendix shows the results of the Dickey-Fuller test on the study variables. It is observed that the LGDP variable is non-stationary at level; therefore, first differences are taken. Following the methodology, Model [3] of Dickey-Fuller is estimated. To detect the presence of a deterministic trend, the following hypotheses are considered:

$$\begin{cases} H_0: b = 0 & \text{No trend exists} \\ H_1: b \neq 0 & \text{Trend exists} \end{cases}$$

Since the p-value corresponding to the trend coefficient is 0.77, which is greater than 0.05, we fail to reject the null hypothesis and reject the alternative hypothesis. This indicates that there is no deterministic trend in the model.

Following the methodology, Model [2] is estimated to detect the presence of a constant, using the hypotheses:

$$\begin{cases} H_0: c = 0 & \text{No constant exists} \\ H_1: c \neq 0 & \text{Constant exists} \end{cases}$$

Since the p-value corresponding to the coefficient is 0.00, which is less than 0.05, we reject the null hypothesis and accept the alternative hypothesis. This indicates that a constant is present in the model.

Furthermore, to detect the presence of a unit root, the following hypotheses are used:

$$\begin{cases} H_0: \rho = 0 & \text{Unit root exists} \\ H_1: \rho \neq 0 & \text{No unit root exists} \end{cases}$$

Since the p-value of the unit root test is 0.00, which is less than 0.05, we reject the null hypothesis and accept the alternative hypothesis, indicating that no unit root exists in the model.

According to the simplified methodology for unit root tests applied to all variables, it is concluded that all variables are integrated of order one, I(1), except for Foreign Direct Investment (FDI), which is stationary at level, I(0).

3.3. Results of the Cointegration Test:

To examine the existence of cointegration among the model variables, which implies the presence of a long-run equilibrium relationship, the F-Bounds Test within the Autoregressive Distributed Lag (ARDL) framework is employed.

To determine whether a cointegrating relationship exists, representing a long-run equilibrium relationship among the variables under study, the Bounds Test Approach is applied. This approach has the advantage of being applicable regardless of whether the explanatory variables are integrated of order zero, I(0), order one, I(1), or a combination of both. Furthermore, it is suitable for small-sample analyses.

The approach is based on the F-statistic, whereby the null hypothesis (H_0) of no cointegration among the model variables is tested against the alternative hypothesis (H_1) of the existence of cointegration among the estimated model variables.

The ARDL model was estimated using EViews 12 software, which enables cointegration testing through the Bounds Test procedure. Appendix (2) reports the results of the cointegration test using this approach. The findings indicate that the calculated F-statistic is ($F = 7.34$), which exceeds the upper critical bound values corresponding to the sample size and degrees of freedom at the 1%, 5%, and 10% significance levels. Therefore, the null hypothesis is rejected in favor of the alternative hypothesis, leading to the conclusion that a cointegrating relationship exists among the estimated model variables, implying the presence of a long-run equilibrium relationship.

Table 2: Summary of Cointegration Test Results (Bound Tests)

F-statistic	Critical F-values	Significance level		
		1%	5%	10%
	7.34	I(0) 2.88	2.27	1.99
		I(1) 3.99	3.28	2.94

Source: Prepared by the authors based on outputs from EViews 12.

3.4. Estimating the Functional Relationship Using the ARDL Model :

The stationarity tests conducted on the study variables indicated that the time series are stationary at both the level and first difference. Furthermore, the cointegration test revealed the existence of a long-run equilibrium relationship among the variables. Therefore, the ARDL model can be applied, as it allows for the estimation of both the long-run and short-run relationships among the model variables, that is, the assessment of the long-run and short-run effects of the determinants of modern economic growth in Algeria over the period (1990–2023).

3.4.1. Cointegration Regression Based on the ARDL Model:

Appendix (3) presents the results of the cointegration regression and the estimated regression functions based on the ARDL model using EViews 12, which automatically selects the optimal lag lengths according to the Akaike Information Criterion (AIC). The statistical tests indicated the overall significance of the model through the F-test, with a probability value of (Prob = 0.000). In addition, the adjusted coefficient of determination (Adjusted R²) was high, reaching 0.99.

Table (02) presents the diagnostic tests of the estimated model. The results of the essential diagnostic tests performed to assess the validity of the model showed the absence of any econometric problems that could adversely affect the accuracy or bias of the estimation results. The findings indicated that the estimated model is free from the problem of serial correlation, as evidenced by both the Lagrange Multiplier (LM) test and the F-test, which were statistically insignificant at the 5% significance level, with corresponding probability values of 0.91 and 0.93, respectively.

Similarly, the estimated model was found to be free from the problem of heteroskedasticity of the error term, as indicated by the Lagrange Multiplier (LM) test and the F-test, whose probability values were 0.54 and 0.65, respectively, both exceeding the 5% significance level.

The table also shows that the probability value of the Jarque–Bera test is 0.96, which is greater than 5%; therefore, the null hypothesis is accepted, indicating that the residuals are normally distributed.

Furthermore, the table demonstrates, through the Ramsey RESET test, that the estimated model is correctly specified. This is confirmed by the probability value associated with the F-statistic, which equals 0.07, exceeding the 5% significance level.

Table 03: Model Diagnostic Test Results

Test	Test Statistic	p-value	Statistical Decision
LM Test	0.01	0.91	No autocorrelation in the residuals
F Test	0.00	0.93	No autocorrelation in the residuals
LM Test	12.72	0.54	Homoscedasticity of residuals
F Test	0.80	0.65	Homoscedasticity of residuals
Jarque-Bera Test	0.07	0.96	Residuals are normally distributed
Ramesy Test	3.51	0.07	The model is correctly specified

Source: Prepared by the authors based on outputs from EViews 12.

3.4.2. Estimation of the Error Correction Model and Short- and Long-Run Relationships Based on the ARDL Model:

The short-run relationship among the variables under study is determined through the estimation of the Error Correction Model (ECM), which represents the second step of the ARDL approach according to the previous equation. The model expresses the variables in their first-difference form while incorporating the Error Correction Term, denoted by ECT_{t-1} , with one lag period. The coefficient of this term is expected to be negative and less than unity ($\lambda < 1$). The parameter λ represents the speed at which short-run equilibrium adjusts toward long-run equilibrium. By dividing the estimated coefficients by the coefficient of the error correction term, the long-run coefficients can be obtained.

Table (03) presents the Error Correction Model and the short-run coefficients of the variables under study. The results indicate that the variables foreign direct investment and mean years of schooling exhibit the expected signs, as their coefficients are positive, reflecting a direct relationship with gross domestic product (GDP). The corresponding probability values were (Prob = 0.00) and (Prob = 0.25), respectively. This implies that a 1% increase in foreign direct investment and mean years of schooling leads to an increase in GDP of 0.002% and 0.16%, respectively.

In contrast, the coefficient of renewable energy consumption is negative, indicating an inverse relationship with GDP. The variable is statistically significant (Prob = 0.00), suggesting that a 1% increase in renewable energy consumption leads to a 0.01% decrease in the logarithm of GDP.

The estimated relationship further shows that the coefficient of the error correction term, ECT_{t-1} , denoted by (λ), is equal to -0.49 . The coefficient is negative and statistically significant (Prob = 0.00), confirming the existence of a short-run equilibrium relationship among the variables that converges toward a long-run equilibrium relationship. Moreover, the value of the error correction coefficient (λ) indicates that approximately 49% of the disequilibrium (short-run imbalance) in GDP during the previous period ($t-1$) can be corrected in the current period (t) toward the long-run equilibrium path following any shock or change in the explanatory variables. Thus, λ represents the speed or rate of error correction, which can be considered relatively high and acceptable in terms of restoring equilibrium.

Table 04: Results of the Error Correction Model (ECM) and Short-Run Dynamics
Error Correction Model (ECM) and Short-Run Relationship

Variables	Coefficients	Student's t-statistic	p-value
$\Delta(LFDI)$	0.002	3.38	0.002
$\Delta(LSYM)$	0.16	1.17	0.16
$\Delta(LCR)$	-0.01	-2.60	-0.01
EC_{t-1}	-0.49	-9.10	-0.49

Source: Prepared by the authors based on outputs from EViews 12.

- Table (05) also presents the estimation results of the long-run relationship. The findings indicate that the variable gross fixed capital formation has a positive coefficient of 0.13 and is statistically significant, with a probability value of (Prob = 0.02), which is below the 5% significance level. This result reflects a positive relationship between gross fixed capital formation and gross domestic product (GDP), implying that a 1% increase in gross fixed capital formation leads to a 0.13% increase in GDP.

- The coefficient of trade openness is also positive, amounting to 0.34, and statistically significant (Prob = 0.00). This indicates a positive relationship between trade openness and GDP, such that a 1% increase in trade openness results in a 0.34% increase in GDP.

- The coefficient of foreign direct investment (FDI) is positive but relatively small, equal

to 0.009, and statistically significant (Prob = 0.00) at the 5% significance level. This implies that a 1% increase in FDI leads to a 0.009% increase in GDP.

- The results further show that the coefficient of mean years of schooling is 0.52 and statistically significant (Prob = 0.00). This indicates that a 1% increase in mean years of schooling leads to a 0.52% increase in GDP.

- The variable renewable energy consumption (CR) exhibits a negative coefficient of -0.05 and is statistically significant at the 10% significance level, with a probability value of ($p = 0.09$). This suggests that a 1% increase in renewable energy consumption leads to a 0.05% decrease in GDP.

- The coefficient of carbon dioxide (CO_2) emissions was positive, with an estimated value of 0.43, and was statistically significant (Prob = 0.00) at the 5% significance level. This indicates that a 1% increase in CO_2 emissions leads to a 0.43% increase in Gross Domestic Product (GDP), holding other factors constant.

Table (05): Long-Run Estimation Results

Error Correction Model and Short-Run Dynamics			
Variable	Coefficient	t-Statistic	p-value
LINV	0.13	2.40	0.02
LOUV	0.34	4.00	0.00
LFDI	0.009	3.47	0.00
LSYM	0.52	3.58	0.00
LCR	-0.05	-1.75	0.09
LCO2	0.43	3.20	0.00
C	15.28	6.61	0.00

Source: Prepared by the authors based on outputs from EViews 12

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3.4.3. Stability Test of the Estimated ARDL Model:

The structural stability of the estimated ARDL model for both the short-run and long-run relationships was examined using the Cumulative Sum of Recursive Residuals (CUSUM) test and the Cumulative Sum of Squares of Recursive Residuals (CUSUMSQ) test. If the plotted statistics remain within the 5% confidence bounds, the null hypothesis that all estimated parameters are stable cannot be rejected. As illustrated in Figures 3 and 4 in Appendix 4, both plots lie within the 5% critical bounds, confirming the stability of the estimated short-run and long-run coefficients. These findings indicate that the estimated ARDL model is structurally stable and that its parameter estimates are reliable over the study period.

4. Conclusion:

This study aimed to estimate the determinants of the modern economic growth model in Algeria in both the short-run and long-run over the period (1990–2023). The analysis relied on the Bounds Testing Approach to Cointegration to verify the existence of a long-run equilibrium relationship, and on the Auto-Regressive Distributed Lag (ARDL) model to estimate both short-run and long-run coefficients. The main findings of the study are summarized as follows:

4.1. Study Results:

- The econometric results indicate the existence of a long-run equilibrium relationship and cointegration between economic growth and its determinants, despite short-run disequilibria. Economic growth tends to converge toward its long-run equilibrium level. In each period, approximately -0.49 of the disequilibrium from the previous period ($t-1$), represented by the adjustment coefficient, is corrected. This means that when the economic growth rate deviates in the short run ($t-1$) from its long-run equilibrium value, about 49% of this disequilibrium is corrected in period t .

- The model results show that 99% of the variation in GDP is explained by changes in

its determinants, while the remaining proportion is attributed to other minor influencing variables. The model successfully passed all statistical diagnostic tests, indicating its suitability, stability, and high goodness-of-fit.

- The variable gross fixed capital formation is positive (0.13) and statistically significant. This result suggests that domestic investment has a positive impact on economic growth, as it enhances productivity and expands economic capacity. It also has a positive effect through expenditure on infrastructure and basic facilities, which facilitates transportation, reduces costs, and thereby stimulates both domestic and foreign investment.

- The coefficient of trade openness is positive (0.34) and statistically significant, meaning that Algeria's integration into international trade stimulates economic activity by expanding export markets, particularly hydrocarbon exports, increasing foreign investment inflows through global economic integration, facilitating technology and knowledge transfer via trade and imports, improving efficiency and productivity due to increased external competition, and providing modern inputs and machinery required for domestic production. All of these factors positively affect economic growth.

- The coefficient of foreign direct investment (FDI) is positive (0.009) and statistically significant, indicating a direct relationship with GDP. This suggests that increases in FDI contribute to higher economic growth. However, the relatively small magnitude of the coefficient implies that this contribution is limited. This is mainly due to Algeria's heavy dependence on hydrocarbon revenues and public expenditure, which reduces the relative role of FDI in explaining economic growth.

- The variable mean years of schooling is equal to (0.52) and statistically significant. This reflects the important role of education in modern growth theories, highlighting the positive effect of human capital through innovation and technological creation, thereby contributing significantly to economic growth.

- The variable renewable energy consumption (CR) is negative (−0.05) and statistically significant, while carbon dioxide (CO₂) emissions are positive (0.43) and statistically significant. Although renewable energy supports sustainable development, its effect may remain weak due to unplanned transition costs, insufficient investment, or underdeveloped infrastructure. Moreover, an increase in renewable energy consumption alone is not sufficient to stimulate growth unless accompanied by reforms in education, infrastructure, and market structure.

The positive coefficient of CO₂ emissions indicates that higher emissions are associated with higher economic growth. However, this does not imply that pollution is beneficial per se; rather, it reflects that increases in emissions are often a by-product of expanding economic activity, industrial production, and energy consumption. Algeria's economy relies heavily on fossil fuels (oil and gas), meaning that periods of higher growth are typically accompanied by increased energy use and emissions. CO₂ emissions may therefore act as an indirect indicator of economic activity and industrial output. These findings are consistent with the upward phase of the Environmental Kuznets Curve (EKC), where economic growth is associated with rising carbon emissions due to intensive reliance on conventional energy sources. Furthermore, the weak or negative effect of renewable energy reflects that the economy has not yet reached the energy transition stage that allows for decoupling economic growth from environmental degradation, which corresponds to the downward phase of the EKC.

4.2. Recommendations:

Based on the above findings, the study reaches the following recommendations:

- Algeria needs to deepen and accelerate reforms, as there is a need to achieve three fundamental structural shifts in the sources of GDP growth: from oil-based growth to non-oil sectors; from state-dominated public sector activities to market-oriented private sector activities; and from import-substitution activities characterized by protectionism to

competitive export-oriented activities.

- Investment in human capital, which is considered one of the most important determinants of modern economic growth, should be strengthened through encouraging research and development, increasing effective spending on education, and promoting innovation. Algeria has recorded weak performance in terms of human capital indicators, the number of patents, and the quality of education compared to both developing and developed countries.

- Public consumption expenditure should be increased and rationalized, with a redirection of spending toward infrastructure and basic facilities, as well as the development of transport and communication networks, which are among the most important factors in attracting foreign investors.

- Effective and efficient monetary and fiscal policies should be adopted in order to reduce inflation rates, which hinder the pace of economic development. Since the 1990s, Algeria has relied on expansionary fiscal and monetary policies that have contributed to higher inflation rates.

- Foreign trade should be liberalized, and economic blocs and integration frameworks should be strengthened, such as the ASEAN group and the European Union, in order to facilitate the movement of goods, services, and labor, and to improve workforce skills through interaction with foreign investors.

- Foreign direct investment should be encouraged by creating a favorable investment environment through simplifying investment-related procedures, facilitating technology transfer, and improving production processes through interaction and cooperation with foreign investors.

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5. Appendices:

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Appendix (1): Stationarity Test									
Results of the Augmented Dickey-Fuller (ADF) Unit Root Test									
UNIT ROOT TEST RESULTS TABLE (ADF)									
Null Hypothesis: the variable has a unit root									
		At Level							
			LGDP	INV	LOUV	LFDI	LSYM	LCR	LCO2
		t-Statistic	-0.0112	-1.3385	-2.0827	-5.2185	-1.6040	-0.9100	0.0716
With Constant	Prob.	0.9508	0.5998	0.2527	0.0002	0.4690	0.7720	0.9585	
		n0	n0	n0	***	n0	n0	n0	
With Constant & Trend	t-Statistic	-1.6217	-1.7888	-1.7161	-2.6377	-2.7669	-3.3480	-1.7365	
	Prob.	0.7624	0.6873	0.7213	0.2673	0.2189	0.0762	0.7120	
		n0	n0	n0	n0	n0	*	n0	
Without Constant & Trend	t-Statistic	6.3846	0.0699	-0.5201	0.1062	1.0826	-0.4486	4.3488	
	Prob.	1.0000	0.6981	0.4823	0.7091	0.9236	0.5125	1.0000	
		n0	n0	n0	n0	n0	n0	n0	
		At First Difference							
			d(LGDP)	d(INV)	d(LOUV)	d(LFDI)	d(LSYM)	d(LCR)	d(LCO2)
		t-Statistic	-4.2570	-4.6398	-1.3166	-4.4236	-2.4265	-8.5979	-5.5061
With Constant	Prob.	0.0022	0.0008	0.6075	0.0014	0.1428	0.0000	0.0001	
		***	***	n0	***	n0	***	***	
With Constant & Trend	t-Statistic	-4.1876	-4.5789	-7.2672	-4.3391	-2.4779	-8.6610	-5.4729	
	Prob.	0.0122	0.0048	0.0000	0.0088	0.3360	0.0000	0.0005	
		**	***	***	***	n0	***	***	
Without Constant & Trend	t-Statistic	-1.2364	-4.6941	-6.7565	-5.9053	-2.1108	-8.7250	-1.3739	
	Prob.	0.1939	0.0000	0.0000	0.0000	0.0353	0.0000	0.1538	
		n0	***	***	***	**	***	n0	

Source: Prepared by the authors using EViews 12.

Dickey–Fuller Test for the Variable DLGDP**According to the Simplified Methodology for Unit Root Testing.**

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

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-4.187573	0.0122
Test critical values: 1% level	-4.273277	
5% level	-3.557759	
10% level	-3.212361	

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

Augmented Dickey-Fuller Test Equation
 Dependent Variable: D(LGDP,2)
 Method: Least Squares
 Date: 06/01/26 Time: 11:37
 Sample (adjusted): 3 34
 Included observations: 32 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LGDP(-1))	-0.713345	0.170348	-4.187573	0.0002
C	0.021928	0.009463	2.317274	0.0277
@TREND("1")	-0.000122	0.000427	-0.284924	0.7777
R-squared	0.378327	Mean dependent var		0.001633
Adjusted R-squared	0.335454	S.D. dependent var		0.027382
S.E. of regression	0.022322	Akaike info criterion		-4.677448
Sum squared resid	0.014450	Schwarz criterion		-4.540035
Log likelihood	77.83917	Hannan-Quinn criter.		-4.631899
F-statistic	8.824178	Durbin-Watson stat		2.081226
Prob(F-statistic)	0.001015			

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

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-4.257019	0.0022
Test critical values: 1% level	-3.653730	
5% level	-2.957110	
10% level	-2.617434	

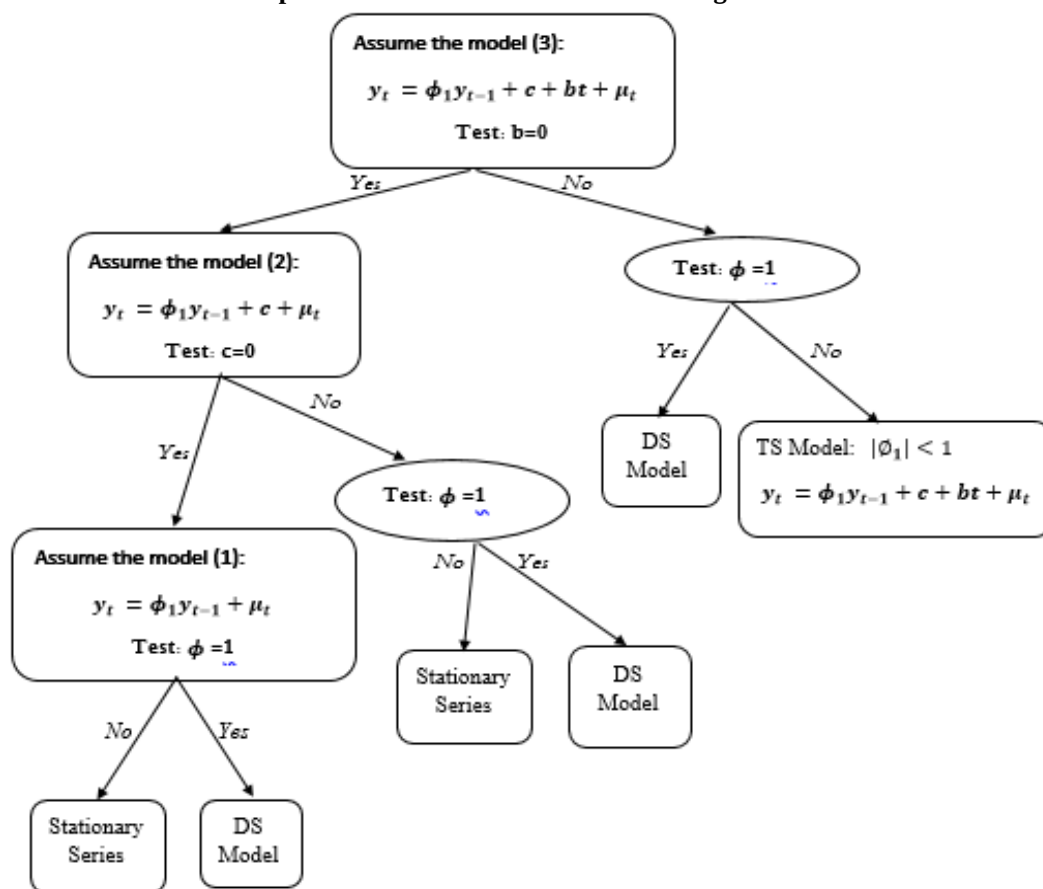
*Mackinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
 Dependent Variable: D(LGDP,2)
 Method: Least Squares
 Date: 06/01/26 Time: 11:34
 Sample (adjusted): 3 34
 Included observations: 32 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LGDP(-1))	-0.713932	0.167707	-4.257019	0.0002
C	0.019812	0.005773	3.431704	0.0018
R-squared	0.376587	Mean dependent var		0.001633
Adjusted R-squared	0.355807	S.D. dependent var		0.027382
S.E. of regression	0.021977	Akaike info criterion		-4.737152
Sum squared resid	0.014490	Schwarz criterion		-4.645544
Log likelihood	77.79444	Hannan-Quinn criter.		-4.706787
F-statistic	18.12221	Durbin-Watson stat		2.073890
Prob(F-statistic)	0.000188			

Source: Prepared by the authors using EViews 12.

Simplified Procedure for Unit Root Testing.



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Source: Bourbonnais, R. (2015). *Économétrie* (9th ed.). Paris: Dunod, p. 251.

Appendix (2): Results of the Cointegration Test Using the Bounds Testing Approach

F-Bounds Test

Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	7.347725	10%	1.99	2.94
k	6	5%	2.27	3.28
		2.5%	2.55	3.61
		1%	2.88	3.99

Source: Prepared by the authors using EViews 12.

Appendix (3): Estimation of the Cointegration Regression Using the ARDL Model

Dependent Variable: LGDP
 Method: ARDL
 Date: 06/01/26 Time: 11:44
 Sample (adjusted): 3 34
 Included observations: 32 after adjustments
 Maximum dependent lags: 2 (Automatic selection)
 Model selection method: Akaike info criterion (AIC)
 Dynamic regressors (2 lags, automatic): LINV LOUV LFDI LSYM LCR LCO2

Fixed regressors: C
 Number of models evaluated: 1458
 Selected Model: ARDL(2, 0, 0, 2, 2, 2, 0)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LGDP(-1)	0.783264	0.160641	4.875866	0.0001
LGDP(-2)	-0.278488	0.159376	-1.747370	0.0986
LINV	0.069176	0.035141	1.968517	0.0655
LOUV	0.169583	0.033891	5.003716	0.0001
LFDI	0.002588	0.001219	2.123946	0.0486
LFDI(-1)	0.000291	0.001319	0.220867	0.8278
LFDI(-2)	0.001819	0.001098	1.656499	0.1160
LSYM	0.164472	0.218987	0.751056	0.4629
LSYM(-1)	-0.416657	0.360467	-1.155881	0.2637
LSYM(-2)	0.511245	0.220096	2.322824	0.0329
LCR	-0.010904	0.007270	-1.499762	0.1520
LCR(-1)	0.000328	0.006859	0.047843	0.9624
LCR(-2)	-0.017573	0.006682	-2.630106	0.0176
LCO2	0.213967	0.103580	2.065725	0.0544
C	7.567858	1.533869	4.933834	0.0001
R-squared	0.998640	Mean dependent var	25.68423	
Adjusted R-squared	0.997519	S.D. dependent var	0.294160	
S.E. of regression	0.014651	Akaike info criterion	-5.303641	
Sum squared resid	0.003649	Schwarz criterion	-4.616577	
Log likelihood	99.85826	Hannan-Quinn criter.	-5.075899	
F-statistic	891.4084	Durbin-Watson stat	2.017637	
Prob(F-statistic)	0.000000			

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

Source: Prepared by the authors using EViews 12.

Appendix (4): Diagnostic Tests

Table (4-1): Results of the Autocorrelation Tests

Breusch-Godfrey Serial Correlation LM Test:

Null hypothesis: No serial correlation at up to 1 lag

F-statistic	0.006193	Prob. F(1,16)	0.9382
Obs*R-squared	0.012382	Prob. Chi-Square(1)	0.9114

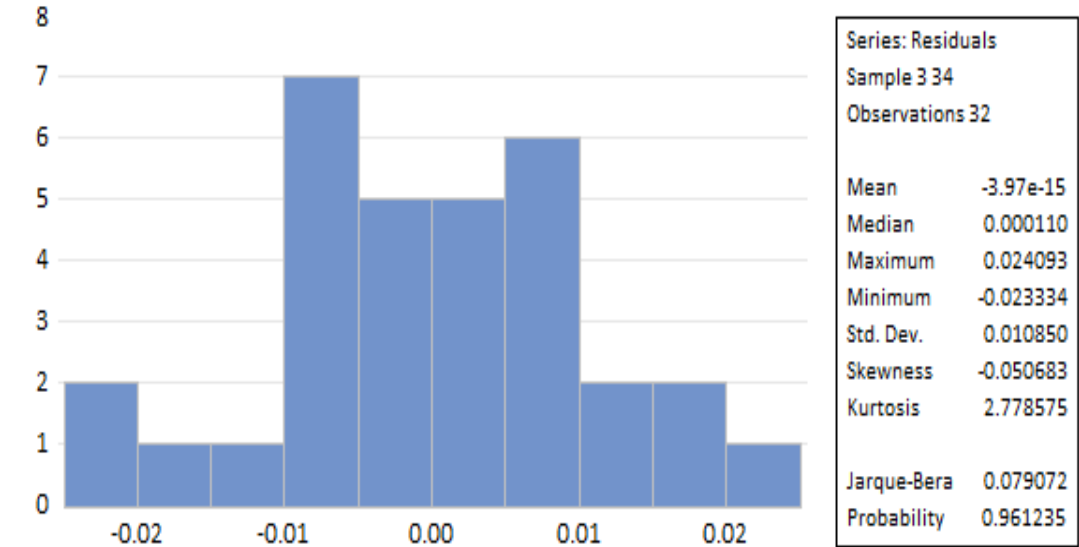
Table (4-2): Results of the Heteroskedasticity Tests

Heteroskedasticity Test: Breusch-Pagan-Godfrey

Null hypothesis: Homoskedasticity

F-statistic	0.802042	Prob. F(14,17)	0.6579
Obs*R-squared	12.72876	Prob. Chi-Square(14)	0.5480
Scaled explained SS	3.194670	Prob. Chi-Square(14)	0.9987

Table (4-3): Results of the Normality Test of the Residuals



Source: Prepared by the authors using EViews 12.

Results of the Model Diagnostic Tests

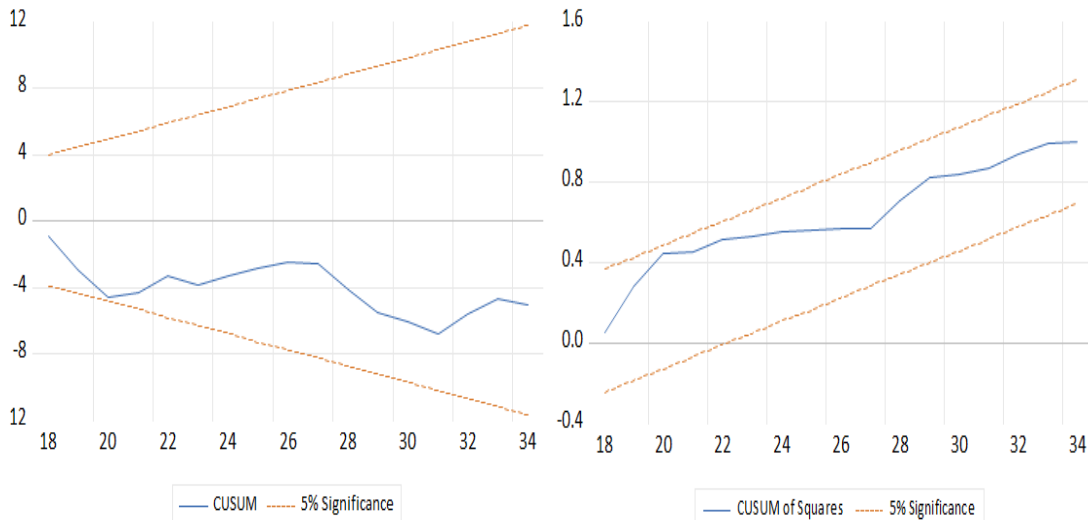
Ramsey RESET Test
Equation: UNTITLED
Omitted Variables: Squares of fitted values
Specification: LGDP LGDP(-1) LGDP(-2) LINV LOUV LFDI LFDI(-1) LFDI(-2) LSYM LSYM(-1) LSYM(-2) LCR LCR(-1) LCR(-2) LCO2 C

	Value	df	Probability
t-statistic	1.875460	16	0.0791
F-statistic	3.517351	(1, 16)	0.0791
Likelihood ratio	6.358885	1	0.0117

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Figure (4-4): Cumulative Sum of the Residuals Figure (4-5): Cumulative Sum of Squares of the Residuals



Source: Prepared by the authors using EViews 12.

Appendix (5): Estimation of the Error Correction Model and the Short-Run Relationship
 ARDL Error Correction Regression
 Dependent Variable: D(LGDP)
 Selected Model: ARDL(2, 0, 0, 2, 2, 2, 0)
 Case 2: Restricted Constant and No Trend
 Date: 06/01/26 Time: 11:46
 Sample: 1 34
 Included observations: 32

ECM Regression Case 2: Restricted Constant and No Trend				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LGDP(-1))	0.278488	0.081797	3.404629	0.0034
D(LFDI)	0.002588	0.000766	3.381058	0.0036
D(LFDI(-1))	-0.001819	0.000758	-2.398139	0.0282
D(LSYM)	0.164472	0.139427	1.179628	0.2544
D(LSYM(-1))	-0.511245	0.158006	-3.235615	0.0049
D(LCR)	-0.010904	0.004180	-2.608320	0.0184
D(LCR(-1))	0.017573	0.004470	3.931674	0.0011
CointEq(-1)*	-0.495224	0.054363	-9.109669	0.0000
R-squared	0.770432	Mean dependent var		0.027096
Adjusted R-squared	0.703475	S.D. dependent var		0.022644
S.E. of regression	0.012331	Akaike info criterion		-5.741141
Sum squared resid	0.003649	Schwarz criterion		-5.374707
Log likelihood	99.85826	Hannan-Quinn criter.		-5.619678
Durbin-Watson stat	2.017637			

* p-value incompatible with t-Bounds distribution.

Appendix (6): Estimation of the Error Correction Model and the Long-Run Relationship

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LINV	0.139686	0.058176	2.401083	0.0281
LOUV	0.342437	0.085597	4.000565	0.0009
LFDI	0.009487	0.002727	3.479166	0.0029
LSYM	0.523116	0.145788	3.588194	0.0023
LCR	-0.056841	0.032454	-1.751452	0.0979
LCO2	0.432061	0.134746	3.206492	0.0052
C	15.28167	2.308736	6.619065	0.0000

Source: Prepared by the authors using EViews 12.

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