Science, Education and Innovations in the Context of Modern Problems

Issue 11, Vol. 8, 2025

Title of research article

An Econometric Analysis of the Dynamic Impact of Investment Expenditures on Economic Growth in Algeria: Evidence from the ARDL Approach (1992–2022)

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Issue web link https://imcra-az.org/archive/385-science-education-and-innovations-in-the-context-of-modern-problems-issue-11-vol-8-2025.html

Keywords Public expenditures; investment expenditures; economic growth; ARDL model; Algeria

Abstract

This study examines the dynamic relationship between investment expenditures and economic growth in Algeria over the period 1992–2022. The research highlights the strategic importance of investment spending in resource-dependent economies and situates Algeria's fiscal trajectory within broader theoretical frameworks, including classical and endogenous growth models.

Methodologically, the study employs the Autoregressive Distributed Lag (ARDL) model to assess both the short-run and long-run linkages between investment expenditures and gross domestic product (GDP) growth. The results reveal a statistically significant positive relationship: a 1% increase in investment expenditures is associated with a 0.11% rise in GDP growth. The findings demonstrate long-run complementarities between investment policies and sustainable growth, alongside short-run adjustments that reflect gradual transmission of expenditure shocks to growth outcomes.

The policy implications underscore the necessity for Algeria to consolidate stable investment frameworks, strengthen resource allocation efficiency, and pursue economic diversification beyond hydrocarbons. Investment in infrastructure, human capital, and technological capacity is identified as a critical pathway toward resilience against external shocks and sustainable development.

Citation. Dalila T. (2025). An Econometric Analysis of the Dynamic Impact of Investment Expenditures on Economic Growth in Algeria: Evidence from the ARDL Approach (1992–2022). *Science, Education and Innovations in the Context of Modern Problems*, 8(11), 974–983. https://doi.org/10.56352/sei/8.11.78
JEL Codes: F43, H50

Received: 10.01.2025 | Accepted: 20.06.2025 | Published: 16.09.2025 (available online)

1. Introduction

Economic growth represents one of the most critical indicators of a nation's economic performance, standard of living, and development trajectory. Consequently, it has been the focal point of extensive research exploring determinants and policy levers. Among these, public expenditures constitute a fundamental fiscal instrument influencing growth, though their impact varies depending on country-specific structures and resource bases.

In Algeria, successive governments have adopted large-scale expenditure programs to stimulate growth and reduce structural vulnerabilities. These initiatives reflect both developmental imperatives and the challenges of a hydrocarbon-dependent economy. Against this backdrop, this study addresses the following central research question:

How do investment expenditures affect economic growth in Algeria during the period 1992–2022?

To guide the investigation, three sub-questions are posed:

1. What are the classifications of public expenditures in Algeria?
2. To what extent have investment expenditures contributed to economic growth?
3. What is the nature of the relationship between investment expenditures and growth in the Algerian context?

The objectives are fourfold:

- To delineate the theoretical foundations of public expenditures and economic growth.
- To classify and analyze public expenditures in Algeria.
- To quantify the impact of investment expenditures on economic growth between 1992–2022.
- To provide policy insights for future fiscal planning.

The remainder of the article is structured as follows. Section 2 reviews the conceptual underpinnings of public and investment expenditures. Section 3 presents the methodological approach, including the ARDL framework. Section 4 discusses the empirical results. Section 5 outlines policy implications, while Section 6 concludes.

2. Conceptual Framework: Investment Expenditures and Economic Growth

2.1 Public Expenditures

Public expenditures are generally defined as the financial resources disbursed by the state or its institutions to meet collective needs and promote socio-economic objectives. They represent cash outflows from the state treasury authorized by legislative bodies to provide public goods and services (Mustafa, 2007). Scholars emphasize that such expenditures embody both economic and social dimensions, aiming to secure public welfare and stimulate development (Mokhtari & Haddad, 2021; Youcef, 2023).

Over time, public expenditures have displayed a tendency to increase, driven by multiple factors: expansion of public sector activities, higher spending on housing, education, health, and social protection; subsidies for production and consumption; rising public sector wages; increasing defense budgets; and the burden of debt servicing (Lahcen, 2013).

2.2 Classification of Public Expenditures

No single classification system applies universally, as countries adopt varied approaches depending on policy priorities and institutional contexts (Youcef, 2023). Commonly, expenditures are categorized as follows:

- **By purpose:**
    - Administrative expenditures: resources allocated to the functioning of state institutions.
    - Social expenditures: transfers aimed at social welfare, including subsidies and pensions.
    - Economic expenditures: investments targeting economic activity and production.
- **By recurrence:**

- Regular expenditures: periodic allocations such as salaries, maintenance, and social services.
- Extraordinary expenditures: irregular spending, including large-scale investment projects or disaster responses.

- **By economic impact:**
  - Current expenditures: recurrent spending necessary for public administration.
  - Capital expenditures: outlays that contribute to capital formation and production capacity, including infrastructure and investment projects.

2.3 Investment Expenditures and Growth

Investment expenditures, as a subset of public spending, are particularly significant in growth theory. According to classical and Keynesian perspectives, such expenditures stimulate aggregate demand and employment, while endogenous growth models highlight their role in fostering innovation, human capital, and long-term productivity.

In Algeria, investment expenditures have historically focused on infrastructure, housing, and industrial development, serving as a mechanism for diversifying the economy beyond hydrocarbons. Their effectiveness, however, depends on institutional efficiency, governance, and the absorptive capacity of the domestic economy.

2.1.2 Classification of Public Expenditures in Algeria

The classification of public expenditures in Algeria has evolved through successive financial legislations, reflecting institutional reforms and shifts in fiscal governance.

a) Classification under Law 84-17 (1984)

According to Article 20 of Finance Law No. 84-17, public expenditures were initially classified into **management expenditures** and **equipment (investment) expenditures**.

- **Management expenditures** (Article 24) included:
  - Public debt burdens and deductions from revenues.
  - Allocations of public authorities.
  - Expenditures related to operating resources.
  - Public interventions.
- **Equipment (investment) expenditures** (Article 35) comprised:
  - Direct investments undertaken by the state.
  - Investment subsidies granted by the state.
  - Other capital-related expenditures.

This classification reflected Algeria's early post-independence development policies, which emphasized centralized planning and state-led industrialization.

b) Classification under Law 18-15 (2018)

Following the 2018 budgetary reform, Finance Law No. 18-15 introduced a more modern classification system, aligning Algeria with international standards of fiscal transparency and performance-based budgeting. Expenditures are now categorized by:

- **Activity:** encompassing programs and their subdivisions.
- **Economic purpose:** including chapters and sections of expenditure.
- **Major state functions:** assigning responsibilities to specific sectors.
- **Administrative responsibility:** distribution of appropriations among ministries and institutions.

Article 29 further details the composition of economic expenditures, which include: user expenses, management expenses, investment expenses, transfer payments, public debt servicing, financial operations, and contingency expenditures.

2.2 Economic Growth

Economic growth is broadly defined as a sustained increase in a country's gross domestic product (GDP), accompanied by improvements in real per capita income (Dardouri & Sararma, 2021). More specifically, it reflects an expansion of productive capacity through increased resource utilization, technological progress, and structural transformation (Mohammed, 2023).

2.2.1 Types of Economic Growth

According to Hafsi (2022), economic growth can be categorized into three main types:

- **Natural growth:** evolving through historical processes, e.g., transitions from feudalism to capitalism.
- **Transient growth:** driven by temporary or external shocks, such as resource booms, that dissipate over time.
- **Planned growth:** stemming from deliberate national development strategies, dependent on planning efficiency, institutional capacity, and broad societal participation.

2.2.2 Determinants of Economic Growth

Key determinants of growth include (Abdullah & Chikhaoui, 2022):

- **Labor:** the quantitative and qualitative contribution of the workforce, influenced by demographics and productivity.
- **Capital:** accumulation and effective utilization of physical, financial, and human capital resources.
- **Technological development:** the most critical determinant, facilitating innovation, efficiency, and competitiveness across sectors.

3. Relationship Between Investment Expenditures and Economic Growth in Algeria

3.1 Model Specification

To empirically assess the link between investment expenditures and economic growth in Algeria (1992–2022), the study employs the **Autoregressive Distributed Lag (ARDL)** framework introduced by Pesaran et al. (2001). This approach is particularly suitable for small-sample studies involving mixed integration orders [I(0) and I(1)].

The analysis draws upon annual data from the Bank of Algeria and the World Bank, ensuring robustness and comparability. The ARDL model specification is expressed as:

ΔYt=α+∑i=1pβiΔYt−i+∑j=0qγjΔXt−j+ϕYt−1+θXt−1+εt\Delta Y_t = \alpha + \sum_{i=1}^{p}\beta_i \Delta Y_{t-i} + \sum_{j=0}^{q}\gamma_j \Delta X_{t-j} + \phi Y_{t-1} + \theta X_{t-1} + \varepsilon_tΔYt=α+i=1∑pβiΔYt−i+j=0∑qγjΔXt−j+ϕYt−1+θXt−1+εt

Where YtY_tYt represents GDP growth, XtX_tXt represents investment expenditures, and the coefficients capture both short-run and long-run relationships.

3.2 Empirical Results

3.2.1 Unit Root Test

Prior to estimation, the stationarity of the time series was tested using the **Phillips–Perron (PP) test**. Results (Table 1) indicate that both GDP and investment expenditure series are **non-stationary at levels** but become **stationary at first differences**, implying integration of order I(1).

Table 1. Unit Root Test Results (Phillips–Perron Test)

Variables	At Level I(0) (No const., No trend)	At Level I(0) (Const.)	At Level I(0) (Const. & Trend)	At First Diff. I(1) (No const., No trend)	At First Diff. I(1) (Const.)	At First Diff. I(1) (Const. & Trend)	Result
LGDP	1.5229 (0.9654)	-1.0547 (0.9203)	-0.9748 (0.7492)	-3.5730 (0.0009)	-4.3654 (0.0088)	-4.0767 (0.0038)	I(1)
LINVEXP	1.8019 (0.9803)	-1.0061 (0.9281)	-1.5853 (0.4775)	-4.3819 (0.0001)	-4.8447 (0.0028)	-4.7328 (0.0007)	I(1)

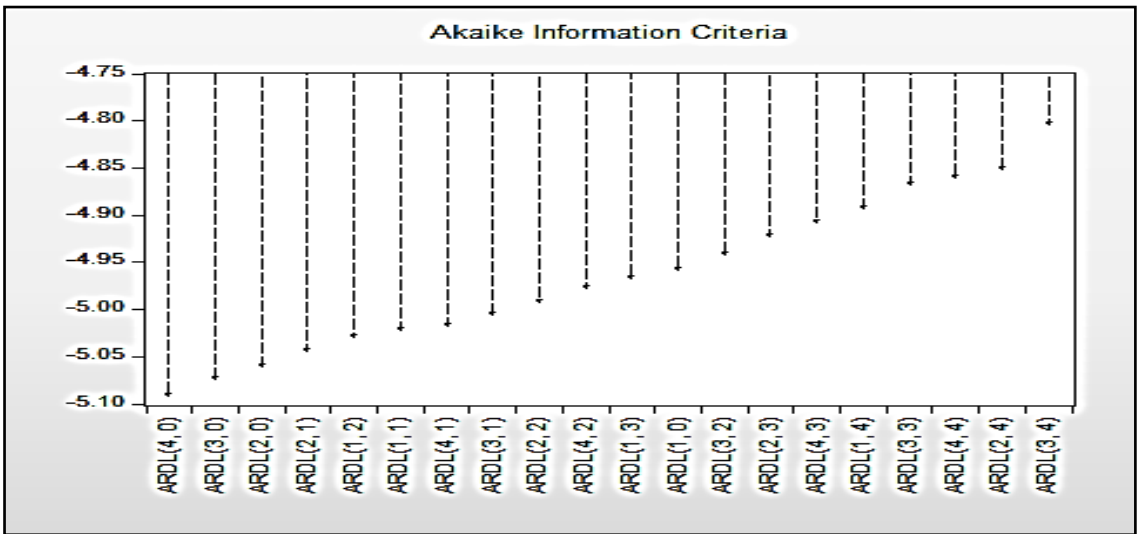
Note: Probability values in parentheses; Source: Author's calculations using EViews 10.

These results satisfy the ARDL preconditions, allowing estimation with a mixture of I(0) and I(1) variables.

3.2.2 Lag Selection

Optimal lag selection was determined using the **Akaike Information Criterion (AIC)**. As shown in Figure 1, the ARDL(4,0) specification yielded the lowest AIC value, confirming its suitability for modeling the dynamic relationship.

Figure 1: : Results of The Optimal Lag periodsTest



Source: Eviews 10 output

3.2.3 Cointegration Test Using the Bounds Approach

To determine whether a long-run equilibrium relationship exists between investment expenditures and economic growth, the **Bounds cointegration test** was applied. The results, presented in Table 2, show that the calculated F-statistic (7.124696) exceeds the upper and lower critical values at the 1%, 2.5%, 5%, and 10% significance levels. Accordingly, the null hypothesis of no cointegration is rejected in favor of the alternative, confirming the existence of a **long-run equilibrium relationship** between the dependent and independent variables.

Table 2. Bounds Cointegration Test Results

Test Statistic	Value	K
F-Statistic	7.124696	1

Significance Level	I(0) Bound	I(1) Bound
10%	3.02	3.51
5%	3.62	4.16
2.5%	4.18	4.79
1%	4.94	5.58

Source: Author's calculations using EViews 10.

3.3 Long-Run and Short-Run Relationship Estimates

3.3.1 Long-Run Relationship

Table 3 reports the long-run coefficients estimated under the ARDL model. The results confirm a **positive and statistically significant effect** of investment expenditures on economic growth. Specifically, a 1% increase in investment expenditures leads to a 0.11% increase in GDP. While the coefficient is modest, it demonstrates that investment spending in Algeria contributes to income expansion and long-term growth dynamics.

Table 3. Long-Run Relationship Estimates

Variable	Coefficient	SE	T-Statistic	Probability
LINVEXP	0.119017	0.007921	15.02571	0.0000
Constant	12.06594	0.058248	207.1488	0.0000

Source: Author's calculations using EViews 10.

3.3.2 Short-Run Relationship

Table 4 presents the short-run dynamics derived from the error correction representation of the ARDL model. The coefficient of the error correction term (CointEq(-1)) is **negative and statistically significant (-0.5935; $p < 0.01$)**, confirming the existence of an adjustment mechanism. This implies that approximately 59.35% of short-term disequilibria are corrected each year to restore the system to long-run equilibrium.

By contrast, investment expenditures exert no statistically significant effect on growth in the short run, underscoring the delayed nature of investment payoffs in the Algerian context.

Table 4. Short-Run Relationship Estimates

Variable	Coefficient	SE	T-Statistic	Probability
D(LGDP(-1))	0.248729	0.143000	1.739366	0.0966
D(LGDP(-2))	0.099747	0.154316	0.646385	0.5250
D(LGDP(-3))	0.285264	0.174389	1.635787	0.1168
CointEq(-1)	-0.593524	0.122671	-4.838350	0.0001

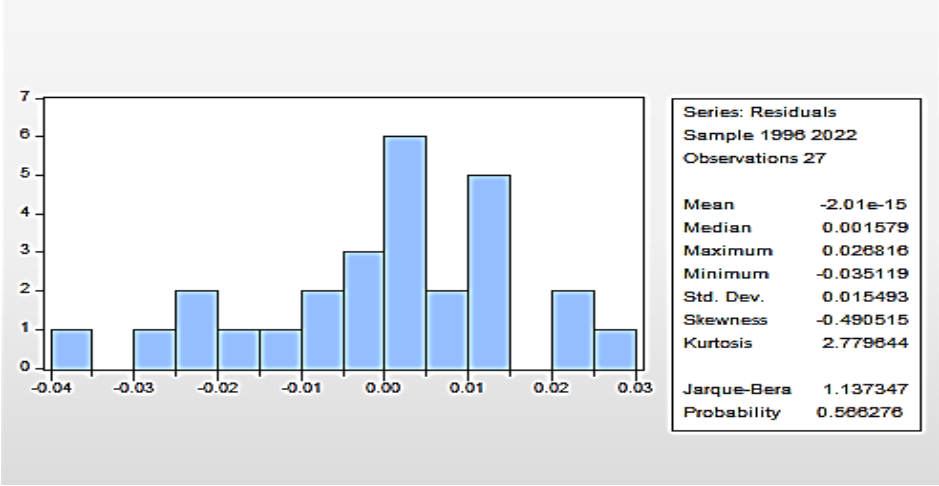
Source: Author's calculations using EViews 10.

3.4 Diagnostic Tests

3.4.1 Normality of Residuals

The **Jarque–Bera (JB) test** was applied to evaluate the normality of the residuals. Figure 2 illustrates that the JB statistic (1.13) is lower than the χ^2 critical value (5.99) at the 5% significance level. Furthermore, the probability value (0.56) exceeds the conventional thresholds, confirming that the model residuals are **normally distributed**, thereby satisfying one of the core assumptions of the ARDL framework.

Figure 2: Results Test of the normality distribution of residuals



Source: Eviews 10 output

3.4.2 Autocorrelation Test of Errors

The Breusch–Godfrey LM test was employed to detect the presence of serial correlation in the residuals. As reported in Table 5, the F-statistic (0.279386) and the Chi-square probability (0.6800) both exceed the 5% significance level. Therefore, the null hypothesis of no autocorrelation cannot be rejected, confirming that the model residuals are **free from serial correlation.**

Table 5. Autocorrelation Test of Errors (LM Test)

Test Statistic	Value	df	Probability
F-Statistic	0.279386	(2,19)	0.7593

Test Statistic	Value	df	Probability
Obs*R-squared	0.771361	(2)	0.6800

Source: Author's calculations using EViews 10.

3.4.3 Heteroskedasticity Test

The Breusch–Pagan–Godfrey test was applied to examine the homoscedasticity of residuals. The results in Table 6 indicate that the F-statistic (0.373600) is statistically insignificant (p = 0.8610), suggesting the absence of heteroskedasticity. Thus, the model satisfies the assumption of constant variance in the residuals.

Table 6. Heteroskedasticity Test Results (Breusch–Pagan–Godfrey)

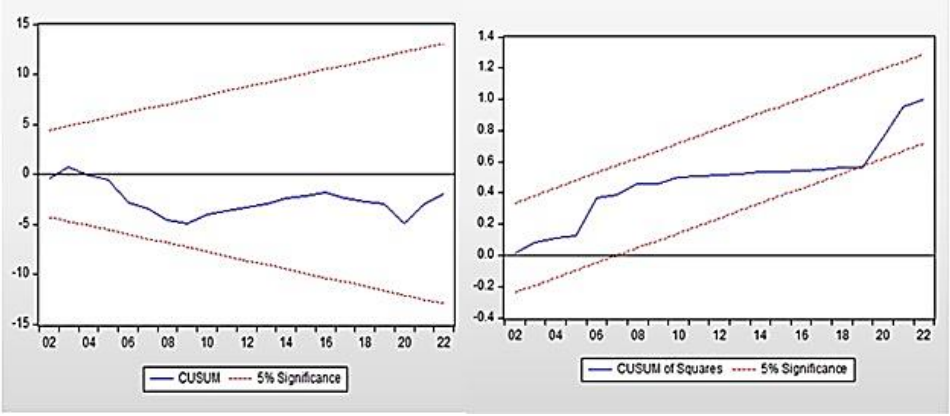
Test Statistic	Value	df	Probability
F-Statistic	0.373600	(5,21)	0.8610
Obs*R-squared	2.205525	(5)	0.8200
Scaled explained SS	1.187207	(5)	0.9461

Source: Author's calculations using EViews 10.

3.4.4 Structural Stability Test

To evaluate the stability of the estimated parameters over the sample period, the **CUSUM and CUSUM of Squares** tests were conducted. Figure 3 illustrates that the plots remained within the 5% critical bounds, thereby confirming that the model is **structurally stable** and reliable for inference throughout the study period.

Figure 3: Structural Stability Tests – CUSUM and CUSUMSQ Plots



Source: Author's calculations using EViews 10.

4. Conclusion and Policy Recommendations

This study analyzed the dynamic impact of investment expenditures on economic growth in Algeria for the period 1992–2022 using the **Autoregressive Distributed Lag (ARDL)** approach. Several conclusions emerge:

1. **Model reliability:** Diagnostic tests (normality, autocorrelation, heteroskedasticity, and stability) confirm the robustness and validity of the estimated ARDL model.

2. **Error correction mechanism:** The negative and statistically significant coefficient of the error correction term (-0.5935) indicates that approximately 59.35% of disequilibria are corrected annually, ensuring a rapid return to long-run equilibrium.

3. **Long-run effect:** Investment expenditures exert a positive and statistically significant effect on economic growth. A 1% increase in investment expenditures raises GDP by 0.11%. However, the elasticity is relatively weak, underscoring the need for complementary growth-enhancing policies.

4. **Short-run effect:** No statistically significant relationship was found between investment expenditures and growth in the short run, reflecting the delayed realization of investment benefits in Algeria's economy.

Policy Recommendations:

- Rationalize investment expenditures, prioritizing sectors with higher productivity and stronger growth spillovers (infrastructure, education, and technology).

- Strengthen oversight and accountability mechanisms to ensure efficient allocation and disbursement of public resources.

- Promote economic diversification by reducing overreliance on hydrocarbons and channeling investments into non-oil sectors.

- Improve institutional quality and governance to enhance the multiplier effect of public investment.

5. Findings

1. **Positive Long-Run Relationship:** Investment expenditures were found to have a long-run elasticity of 0.11, confirming their contribution to Algeria's GDP performance.

2. **Short-Run Dynamics:** Short-run effects are limited, though the strong error correction mechanism ensures that shocks are quickly corrected.

3. **Policy Implications:** Effective resource allocation, diversification of investment, and institutional reforms are required to amplify the modest long-run impact of investment on growth.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Ethical Considerations

This study relies exclusively on secondary macroeconomic data sourced from publicly accessible databases, including the World Bank, the Bank of Algeria, and the International Monetary Fund (IMF). No human or animal subjects were involved, and therefore ethical approval was not required. All data sources are properly acknowledged and cited.

Acknowledgments

The author expresses gratitude to colleagues at the University of Biskra for their insightful feedback on the econometric framework and research design. Sincere appreciation is also extended to the anonymous reviewers for their valuable comments, which significantly improved the quality of this manuscript.

Conflict of Interest

The author declares no conflicts of interest regarding the publication of this study.

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