Public Expenditure and Economic Growth in Algeria: Evidence from ARDL Bounds Testing over the Period 1990–2022

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Abstract:

This paper investigates the impact of public expenditure on economic growth in Algeria over the period 1990–2022 using the Autoregressive Distributed Lag (ARDL) model and the Bounds Testing approach. The results reveal that Algeria's economic growth remains fragile, primarily driven by the hydrocarbon sector, with expansionary fiscal policy failing to ensure sustainable growth. The econometric analysis confirms a long-run cointegrating relationship between public expenditure and GDP. The estimated elasticities of GDP with respect to public expenditure are 0.7125 in the long run and 0.5670 in the short run, while the error correction coefficient (–0.4923) indicates that nearly half of short-term disequilibria are corrected annually. These findings emphasize the need for enhancing fiscal efficiency, improving public spending quality, and promoting economic diversification to achieve stable and sustainable growth in Algeria.

Keywords: **:** Public expenditure; Economic growth; Fiscal policy; ARDL model; Cointegration.

JEL Classification Codes: E62, O47, H50, C22.

ملخص:

تهدف هذه الدراسة إلى تحليل أثر الإنفاق العام على النمو الاقتصادي في الجزائر خلال الفترة 1990–2022، باستخدام نموذج التأخر الذاتي الموزع (ARDL) ومنهج اختبار الحدود. وتشير النتائج إلى هشاشة النمو الاقتصادي الجزائري واعتماده الكبير على قطاع الهيدروكربونات، مع محدودية أثر السياسة المالية التوسعية في تحقيق نمو مستدام. كما يبرز التحليل وجود علاقة تكاملية طويلة الأجل بين الإنفاق العام والناتج المحلي الإجمالي، حيث بلغت المرونات المقدرة 0.7125 على المدى الطويل و0.5670 على المدى القصير، في حين يشير معامل تصحيح الخطأ (–0.4923) إلى تصحيح نصف الاختلالات قصيرة الأجل سنويًا. وتؤكد هذه النتائج ضرورة تعزيز كفاءة الإنفاق العام، وتحسين جودته، وتشجيع التنويع الاقتصادي لتحقيق نمو مستقر ومستدام.

كلمات مفتاحية: الإنفاق العام؛ النمو الاقتصادي؛ السياسة المالية؛ نموذج التأخر الذاتي الموزع(ARDL) ؛ التكامل الطويل الأجل.

تصنيفات JEL: E62, O47, H50, C22.

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1. Introduction

Fiscal policy occupies a central position among the various economic policies, as it plays a pivotal role in achieving the multiple objectives of the national economy. Through its main instruments—public expenditure and taxation—it serves as one of the most effective tools of economic management for promoting economic development and addressing the structural imbalances that hinder macroeconomic stability.

To meet societal goals and satisfy public needs, governments resort to public expenditure, which represents one of the key financial instruments of the state. Public spending largely reflects the effectiveness of government intervention and its impact on economic activity and national development. The scope and magnitude of public expenditure have evolved alongside the transformation of the state's role—from a minimal "night-watchman" state to an interventionist and then a productive state. This expansion has been driven by several factors, most notably the growing share of public expenditure in national income and its increasing use as a tool of economic policy aimed at fostering growth, combating unemployment, and maintaining purchasing power.

Achieving positive and sustainable rates of economic growth remains one of the primary objectives of economic policy pursued by nations through diverse systems and approaches. Keynesian fiscal thought, in particular, emphasized the crucial role of public expenditure as the most effective instrument of fiscal policy in stimulating economic growth. Based on the principle that "demand creates its own supply," Keynesian economics posits that government spending, representing public demand, constitutes a powerful stimulus to aggregate demand, thereby generating a corresponding expansion in output and national income.

In the Algerian context, following the structural imbalances and economic reforms of the 1990s, the country adopted an expansionary fiscal policy characterized by substantial public spending, largely supported by rising oil revenues. Beginning in 2001, Algeria implemented several economic recovery programs aimed at achieving and sustaining economic growth. These programs had a significant impact, particularly in the construction and public works sectors. However, this growth remained fragile, being heavily dependent on the hydrocarbon sector, as evidenced by the economy's vulnerability to external shocks whenever global oil prices declined.

a. Research Problem

Based on the discussion presented earlier, the central research problem of this study revolves around analyzing and measuring the impact of public expenditure on economic growth in Algeria during the period 1990–2022. Accordingly, this study seeks to answer the following main research question:

What is the impact of public expenditure on economic growth in Algeria during the period 1990–2022?

From this main question, several sub-questions emerge:

- What is meant by public expenditure and economic growth?
- What are the economic effects of public expenditure?
- How can the impact of public expenditure on economic growth in Algeria be measured?

b. Research Hypotheses

To address the main research question and its sub-questions, the study is based on the following hypotheses:

- There exists a long-term equilibrium relationship between public expenditure and economic growth in Algeria.
- Public expenditure has a positive long-run effect on economic growth in Algeria.
- Public expenditure has a positive short-run effect on economic growth in Algeria.

c. Research Objectives

This study aims to achieve the following objectives:

- To examine the nature of the impact of public expenditure expansion on economic growth in Algeria during the study period.
- To measure the effect of public expenditure on economic growth in Algeria in both the short and long term.

d. Research Significance

The significance of this study stems from the vital role of public expenditure as a key instrument of fiscal policy in achieving economic growth—one of the principal objectives of economic policy. The importance of this research also lies in its analytical and empirical approach to evaluating the impact of public expenditure expansion on economic growth in Algeria, thereby contributing to the understanding of how fiscal policy can enhance sustainable economic performance.

e. Research Methodology

This study adopts a deductive approach using both descriptive and analytical methods to clarify the theoretical framework of the research, particularly concerning public expenditure and economic growth.

Additionally, the inductive approach is employed through the construction of an Autoregressive Distributed Lag (ARDL) model to measure the relationship between public expenditure and economic growth in Algeria. The analysis involves testing for cointegration, estimating both short-run and long-run relationships, and performing model diagnostics using established econometric criteria to ensure robustness and reliability of results.

2. Section One: Theoretical Framework of Public Expenditure and Economic Growth

I. Public Expenditure: Concept and Theoretical Foundations

Economists have long debated the role and effects of public expenditure on economic activity rather than its definition. As human needs have expanded and diversified, the justification for public spending has grown, making it an essential instrument of modern economic policy. Nevertheless, certain economic, social, and fiscal criteria must be considered when determining the appropriate size and composition of public expenditures.

1.1 Definition of Public Expenditure

Public expenditure generally refers to monetary outlays made by public authorities to satisfy collective needs and promote economic and social welfare. According to classical and modern definitions, public expenditure can be viewed as:

"A monetary amount disbursed from the financial resources of a public entity to meet a collective or public need." (MUSGRAVE & MUSGRAVE, 1989, p. 16)

Recent literature extends this notion to include all government spending aimed at delivering public goods, promoting macroeconomic stability, and achieving equitable income distribution. The (OECD, 2021, p. 68)defines public expenditure as "all government payments, whether for consumption, investment, or transfers, intended to provide goods and services for public benefit."

From these definitions, public expenditure can be characterized by three essential elements:

1. **A monetary nature** – expenditures involve financial resources;
2. **A public origin** – they are incurred by a government or public institution;
3. **A collective purpose** – they aim to satisfy public or social needs rather than private interests.

1.2 Rationale for Government Intervention in the Economy

The rationale for state intervention in economic activity has evolved through different schools of thought. The **Mercantilists** in the 16th and 17th centuries advocated strong state involvement in trade and industry to enhance national wealth. In contrast, **Adam Smith (1776)**, in *The Wealth of Nations*, introduced the concept of the **"invisible hand"**, arguing that market mechanisms are generally more efficient than state control in allocating resources.

However, subsequent economic developments revealed the limitations of laissez-faire capitalism. Market imperfections, income inequality, and externalities led to the emergence of interventionist theories such as **Keynesian economics**, which emphasized the stabilizing role of public expenditure, particularly in stimulating aggregate demand during recessions (Keynes, 1936, p. 11). More recent perspectives, including **New Institutional Economics** and **Public Choice Theory**, recognize that

while government intervention is necessary, it should be efficient, transparent, and targeted (Stiglitz, 2018) (ACEMOGLU & ROBINSON, 2019) .

The main justification for public sector intervention lies in **market failure**—situations where free markets fail to allocate resources efficiently. Market failures arise from externalities, imperfect competition, asymmetric information, and the public goods nature of certain services (STIGLITZ & ROSENGARD, 2020, p. 561). For example, public goods such as national defense, environmental protection, and public infrastructure cannot be efficiently provided by private markets due to their **non-rivalry** and **non-excludability** characteristics.

In developing economies, such as Algeria, government intervention through public spending is particularly crucial due to underdeveloped markets, limited financial intermediation, and the need for equitable resource allocation. Empirical studies ((IMF), 2022) (World Bank, 2023) have shown that strategic public spending on infrastructure, education, and health can significantly enhance long-term productivity and inclusive growth.

Furthermore, public intervention is often justified by the **scale and risk** of major investment projects. Large-scale infrastructure or strategic industries may involve high levels of uncertainty or externalities that deter private investment. In such cases, initial government involvement is essential to mitigate risks, mobilize capital, and ensure the public good nature of the project (TANZI & SCHUKNECHT, 2020, p. 99). Over time, as markets mature and risks decline, these activities can be gradually transferred to the private sector.

3. Classifications of Public Expenditures

Public expenditures are generally classified according to several criteria that reflect their economic impact, periodicity, and functional purpose (Gayer & Rosen, 2022, p. 123) ((OECD), (2025), p. 45).

3.1. Criterion of Impact on National Income

According to this criterion, public expenditures are divided into **real (productive)** and **transfer** expenditures (MUSGRAVE & MUSGRAVE, 1989) (TANZI & SCHUKNECHT, 2020)

- **a. Real Expenditures:** These are the expenditures made by the state in exchange for obtaining goods and services that contribute directly to production. Such expenditures generate new income and add to the national product — for example, investments in infrastructure, education, or research and development (Gayer & Rosen, 2022) (World Bank, 2023).
- **b. Transfer Expenditures:** These represent the transfer of purchasing power from one social group to another without creating new income. They are generally made without a direct return and aim primarily to redistribute income and reduce social inequalities. Typical examples include social assistance,

subsidies, and pensions ((OECD), (2025)) .

3.2. Criterion of Periodicity and Regularity

According to the periodicity criterion, public expenditures are classified into **ordinary (current)** and **extraordinary (capital)** expenditures ((IMF), 2022).

- **a. Ordinary Expenditures:** These are expenditures that recur regularly in the state's budget every fiscal year. They include public sector salaries, administrative costs, and recurrent operational expenses necessary for the continuous functioning of public services. However, the amounts may vary from year to year (Gayer & Rosen, 2022).
- **b. Extraordinary Expenditures:** These are expenditures that occur irregularly and are not repeated on an annual basis. They are usually associated with exceptional circumstances such as public investment projects, natural disaster recovery, or war efforts. They are often financed through borrowing or special revenues . ((IMF), 2022).

3.3. Functional Classification of Public Expenditures

Based on their purpose, public expenditures can be divided functionally according to the main roles of the state: **administrative, social, and economic** ((OECD), (2025)).

- **a. Administrative Expenditures:** These include expenses related to the functioning of public institutions, ensuring internal security, maintaining diplomatic relations, and providing public administration services. They also cover cultural and educational policies aimed at developing human capital and promoting research and innovation (Gayer & Rosen, 2022).
- **b. Social Expenditures:** These expenditures aim to achieve social development objectives and improve citizens' welfare. They include spending on education, health, transportation, housing, and social protection. Education expenditures, in particular, are a key indicator of a country's level of development (World Bank, 2023).
- **c. Economic Expenditures:** These are expenditures directed toward achieving economic objectives, such as investment in productive infrastructure (transportation, irrigation, and electricity) and various economic subsidies to public or private enterprises. Properly targeted economic expenditures can generate a significant multiplier effect on output and employment (TANZI & SCHUKNECHT, 2020).

II: Economic Growth

Economic growth has long been regarded as a central objective and a persistent challenge pursued by all nations, regardless of their culture or level of development. Over the decades, various economic theories have attempted to explain the dynamics of growth and identify its key determinants. Given its close relationship with multiple

macroeconomic variables, identifying the sources of growth is crucial to designing policies that enhance and sustain it. Consequently, numerous economists have developed and empirically tested models that seek to explain the structural and behavioral determinants of economic growth (AGHION & HOWITT, 2021, p. 127).

1. Definition of Economic Growth

Economic growth has been defined in several ways across the literature, emphasizing its quantitative and qualitative dimensions.

- According to classical and modern economists, **economic growth** refers to the **increase in real national output over time**, reflecting changes in productive capacity and the degree of resource utilization. In other words, the higher the utilization rate of productive capacity across sectors, the greater the rate of national output growth (Todaro & Smith, 2020, p. 150).
- Another definition views **economic growth** as a **sustained increase in real gross domestic product (GDP)** or **gross national income (GNI)**, leading to an improvement in **real per capita income** (Mankiw, 2020, p. 624).

From these definitions, several conclusions emerge:

1. Economic growth is not merely an increase in total income or output, but rather an improvement in individual welfare, which occurs when the rate of national income growth exceeds that of population growth (World Bank, 2023).
2. Growth must be **real**, not nominal—that is, income increases must exceed inflation rates to reflect genuine improvements in living standards.
3. Economic growth is a **long-term process**, not a short-term or temporary phenomenon driven by cyclical or external factors (AGHION & HOWITT, 2021).

2. Key Determinants of Economic Growth

Achieving sustainable economic growth requires the presence of several interrelated components, which constitute the fundamental drivers of expansion and development.

a. Capital Accumulation

Capital accumulation occurs when a portion of income is saved and invested to increase future output and income. This process takes place through productive investment, which requires real savings to be directed toward capital formation rather than consumption (Mankiw, 2020).

Capital goods take various forms, including industrial plants and machinery that indirectly generate goods and services, infrastructure such as transport, energy, and communications systems that facilitate production, and **investment in research and development (R&D)**, which enhances labor and capital productivity. Finally, **investment in human capital**, such as education and health, contributes significantly to productivity growth and the overall efficiency of the economy (OECD, 2021).

b. Population Growth and Labor Force Expansion

Labor is a fundamental factor of production, and population growth influences economic performance through its effect on the labor supply. An expanding labor force increases the number of productive workers and broadens domestic markets, stimulating aggregate demand and production .

However, excessive population growth can strain resources and reduce per capita income unless accompanied by proportional improvements in productivity and capital accumulation (Todaro & Smith, 2020).

c. Technological Progress

Technological progress represents the advancement of scientific and practical knowledge that enhances the efficiency of production processes and introduces new or improved goods and services (ACEMOGLU & ROBINSON, 2019, p. 126)

Empirical evidence shows that **technological innovation** accounts for a significant share of long-term growth in developed economies. For instance, studies estimate that roughly half of U.S. economic growth over the 20th century resulted from technological and managerial improvements rather than capital accumulation alone (Jones, 2016, p. 48). Similarly, during the Industrial Revolution, Britain's rapid economic expansion was largely attributed to technological innovation rather than physical capital formation.

d. Natural Resources

Natural resources, such as land, minerals, and energy, can play a vital role in determining a nation's growth potential. Countries endowed with abundant natural resources often enjoy an initial advantage in capital formation and export earnings (World Bank, 2023).

However, the literature emphasizes that resources alone are insufficient to ensure sustained growth — a phenomenon known as the **"resource curse"** (Sachs & Warner, 2001). Many resource-rich developing countries have failed to achieve sustainable growth due to weak institutions, governance issues, and overreliance on primary commodities. Conversely, nations with limited natural endowments, such as Japan and South Korea, have achieved high growth rates through innovation, human capital development, and efficient economic management (ACEMOGLU & ROBINSON, 2019).

3.Types of Economic Growth and the Economic Effects of Public Expenditure

Economic growth can be classified into several types, the most notable of which are as follows:

1. Natural Growth

Natural growth refers to the type of growth that arises from the internal forces available within the economy without recourse to national-level planning. It is

generally characterized by a slow pace, although it may experience short-term cyclical fluctuations. This form of growth has been typical of advanced capitalist countries since the Industrial Revolution. It requires substantial flexibility within the cultural and social framework on which it rests, as the impulse for growth is transmitted rapidly from one sector to another (Al-Rashdan, 2008, p. 50).

2. Planned Growth

Planned growth occurs as a result of comprehensive planning of a society's resources, needs, and capabilities. The success of this type of growth depends on the competence and expertise of planners, the objectivity of the plans drawn up, and the precision of implementation and follow-up. Furthermore, the active participation of society in both planning and execution at all institutional levels is crucial. If such growth continues over a long period—typically several decades—it can evolve into sustained growth, ultimately transforming into genuine economic development. (Habib & Al-Buni, 2000, p. 23).

3. Unstable or Transitory Growth

Unstable growth is characterized by a lack of continuity and results primarily from temporary external factors. Such growth dissipates once these factors disappear. This type of growth is common in developing economies, where it tends to occur in response to fluctuations in foreign trade and external market conditions.

4. Measuring Economic Growth

Economists generally measure economic growth using the **real Gross Domestic Product (GDP)** rather than the nominal one, as the real GDP accounts for changes in price levels. The main measures of economic growth can be summarized as follows:

a. Monetary Growth Rates

These rates are calculated based on monetary estimates of the size of the national economy, which involves converting tangible goods and services into their monetary equivalents. Despite limitations—such as inaccurate valuation, inflation effects, currency conversion discrepancies, and differences in accounting standards—this remains the most practical and widely used method, particularly after necessary adjustments.

Monetary measures include growth at current prices, constant prices, and international prices (Mohamed & Soheir Abdel-Zaher, 1998, p. 118).

b. Real Growth Rates

Given the rapid population growth in developing countries, often comparable to the growth rate of income and output, it is more appropriate to use indicators of per capita growth. These include the growth rate of per capita national income and per capita GDP, which link economic growth to demographic dynamics.

c. Purchasing Power Parity (PPP) Comparison

International organizations often express national output in U.S. dollars when

publishing comparative economic growth reports. However, this approach is criticized for arbitrarily linking a country's economic strength to exchange rates, which fluctuate considerably. To overcome this, an alternative measure based on **purchasing power parity (PPP)** was developed, reflecting the quantity of goods and services that a unit of national currency can purchase domestically compared to other currencies abroad. (Mohamed & Soheir Abdel-Zaher, 1998, p. 120).

5. Economic Effects of Public Expenditure

Public expenditure influences national output through its effects on both **aggregate demand** and **productive capacity**.

From the demand perspective, public spending constitutes a vital component of effective demand, whose importance increases with greater state intervention in economic life. The relationship between public expenditure and aggregate demand depends on the type and magnitude of spending.

- **Real (productive) expenditures** lead to an increase in national income and aggregate demand by more than the initial amount of spending—an effect explained by the **multiplier principle**.
- **Transfer expenditures**, on the other hand, affect demand depending on how recipients spend these transfers, i.e., on the degree of their leakage from the income cycle (Awadallah, 2003, p. 68).

From the supply side, public expenditure can raise the productive capacity of the national economy, either directly or indirectly, by improving and expanding production factors in both quality and quantity, thus increasing national output and income.

- **Investment expenditures** produce goods and services for public consumption and contribute to the formation of tangible capital for further investment. Such expenditures are considered **productive**, as they increase national income and enhance the economy's productive efficiency (Suzi Adly, 2000, pp. 71-72).

The state may undertake these expenditures directly through production or indirectly through **economic subsidies** granted to public or private enterprises to achieve specific economic objectives—such as price stability, combating inflation, or compensating public enterprises for non-commercial services provided for social benefit.
(Awadallah, 2003, p. 73).

Social expenditures—whether in the form of real or transfer spending—aim to achieve social objectives and have direct effects on production.

- **Cash transfers** (e.g., unemployment benefits, social security payments) enhance the purchasing power of low-income groups, thereby increasing demand for essential goods and stimulating their production.
- **In-kind transfers** (e.g., education, healthcare, housing) directly enhance human capital and productivity, as improvements in workers' education, health, and

living standards translate into higher production capacity. (Suzi Adly, 2000, p. 73).

As for **military expenditures**, their economic impact remains debated. Traditionally, they were viewed as unproductive consumption that reduces national output. However, modern fiscal thought distinguishes between **expansionary** and **contractionary** effects of military spending, depending on the scale and structure of such expenditures. (Awadallah, 2003, p. 70).

Section Two: Empirical Study

The study covers the variables of Gross Domestic Product (GDP) and public expenditures (expressed in billions of Algerian Dinars) over the period 1990–2022. Data for these variables were obtained from the annual reports of the Bank of Algeria, available on the Bank's official website (www.bank-of-algeria.dz), as well as from the publication *"Economic Overview 1962–2020"* issued by the National Office of Statistics (ONS), accessible through its official website (www.ons.dz).

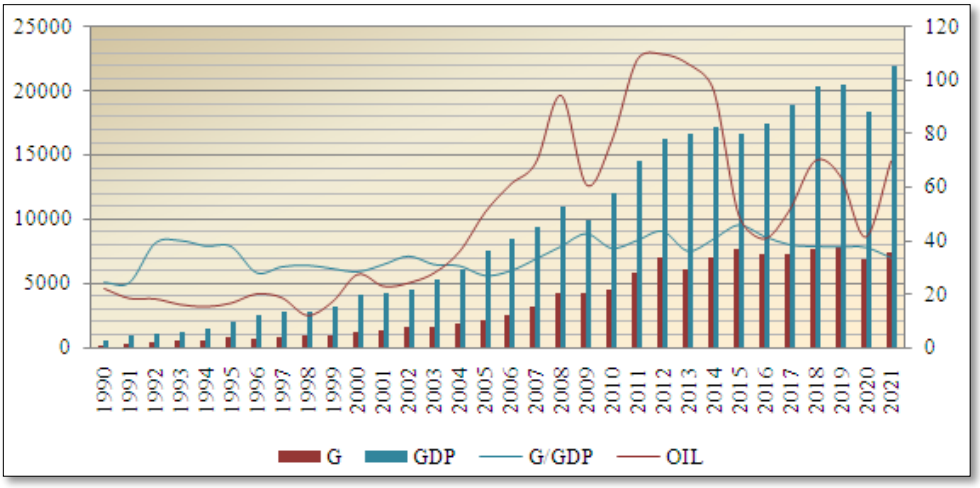
1. Analysis of the Evolution of Study Variables

The oil crisis of 1986 had profound economic and social repercussions on Algeria, particularly during the first half of the 1990s. These effects revealed the fragility of the national economy and its heavy dependence on the hydrocarbon sector. During this period, both public expenditure and economic growth exhibited fluctuations closely linked to movements in global oil prices.

By the late 1990s, with Algeria regaining a measure of stability and improvement in certain economic and social indicators, coupled with a modest recovery in oil prices, public expenditure recorded a growth rate of 22.50%, although its share in GDP declined from 29.69% to 28.54%.

Meanwhile, nominal GDP reached approximately 4,123.51 billion DZD, corresponding to a real growth rate of 3.8%, largely attributable to the rise in oil prices, which averaged USD 27.6 per barrel.

Figure (01): Evolution of Public Expenditure and GDP in Algeria during the Period 1990–2022.



Source: Prepared by the researchers based on the annual reports of the Bank of Algeria and the National Office of Statistics.

The favorable oil prices recorded in the year 2000 enabled Algeria to accumulate a significant financial surplus, which encouraged the adoption of an expansionary fiscal policy through the implementation of several public spending programs. The first of these was the Economic Recovery Support Program (2001–2004), a period marked by the relative stability of oil prices in global markets, with an average of USD 27.90 per barrel. During this program, a number of public investment projects were executed within the framework of the expansionary fiscal policy pursued by the state, aiming to stimulate and sustain economic growth. Public expenditure represented 31.86% of GDP on average over the 2001–2004 period.

Throughout these years, nominal GDP increased from 4,227.11 billion DZD in 2001 to 6,149.11 billion DZD in 2004. This improvement was largely attributed to the significant contribution of the hydrocarbons sector (driven by higher oil prices) and the growth of the construction and public works sector, which benefited from large-scale public investments—representing 22.59% of total investment—and contributed approximately 7.62% to economic growth during the program. The agriculture and irrigation sector also benefited from 20.27% of public investment spending, contributing 8.07% to economic growth during the same period.

With the implementation of the Supplementary Growth Support Program (2005–2009), public spending relative to GDP improved significantly during its first four years, averaging 31.79%. Public investment spending continued to increase, primarily directed toward the construction and public works sector and the agriculture and irrigation sector, accounting for 36.07% and 19.85%, respectively. Nominal GDP continued to grow steadily, rising from 7,561.98 billion DZD in 2005 to 11,043.70 billion DZD in 2008. These positive results were largely due to the expansion of the

hydrocarbons sector, supported by high oil prices that reached USD 94.1 per barrel by the end of 2008, and the strong performance of the construction and public works sector, which recorded an average growth rate of 10.1% over the period.

However, in 2009, the sharp decline in oil prices to USD 60.86 per barrel (compared to USD 94.1 in 2008) led to a stabilization of public expenditure at 4,246.33 billion DZD, representing 42.59% of GDP. Meanwhile, GDP fell to 9,968.02 billion DZD, with a real growth rate of 1.6%, sustained mainly by a 21.1% growth in the agriculture and irrigation sector.

During the 2010–2014 period, under the Growth Consolidation Program, public spending continued to expand substantially, supported by favorable oil prices and higher fiscal revenues. Public expenditure rose from 7,656.33 billion DZD in 2010 to 6,995.76 billion DZD in 2014, accounting on average for 39.54% of GDP during the period. The strong oil prices during this program—reaching USD 109.45 per barrel in 2012—had a major impact on GDP growth, which increased from 11,991.56 billion DZD in 2010 to 17,228.59 billion DZD in 2014, with an average annual growth rate of 3.27%, mainly driven by the hydrocarbons and construction sectors.

The sharp decline in oil prices beginning in the second half of 2014 had a major impact on Algeria's public finances during 2015–2021, forcing the government to scale back planned public expenditure programs (notably the 2015–2019 Five-Year Development Plan) as part of efforts to contain spending and ensure fiscal sustainability over the medium and long term. Consequently, the ratio of public expenditure to GDP fell from 45.81% in 2015 to 33.73% in 2021. GDP growth rates during 2015–2019 remained modest, fluctuating between 3.7% and 1%.

The continuing decline in oil prices, exacerbated by the outbreak of COVID-19 and the associated containment measures, led to an unexpected global economic contraction and a sharp fall in global demand for oil products. As a result, Algeria's GDP recorded a negative growth rate of –5.1% in 2020. However, as oil prices recovered in 2021, reaching USD 69.72 per barrel, GDP improved to 22,021.57 billion DZD, with a real growth rate of approximately 3.4%.

These developments clearly highlight the fragility of Algeria's economic growth during the study period, given its strong dependence on the hydrocarbons sector and the limited success of expansionary fiscal policy in fostering a diversified and productive economic structure capable of sustaining long-term growth.

3. The Empirical Study

Through this empirical study, we will attempt to apply the *Autoregressive Distributed Lag (ARDL)* model to examine the effect of public expenditure on economic growth in Algeria during the period 1990–2022. Accordingly, the study variables are defined as follows:

- Gross Domestic Product (GDP): This is the *dependent variable*, measured in

billions of Algerian dinars (DZD), as it serves as a general indicator of the level of economic activity and a measure of economic growth. It is denoted by the symbol Y.

- Public Expenditure: This is the *independent variable*, also measured in billions of Algerian dinars (DZD), as it represents one of the main fiscal policy variables. It is denoted by the symbol G.

In this study, we will apply the *natural logarithm (ln)* transformation to the variables, as the *double-logarithmic* functional form is widely used due to its computational simplicity, its ability to address the issue of *heteroskedasticity*, and the *economic interpretability* of its coefficients.

1- Testing the Stationarity of the Study Variables:

The following table presents the results of the **Dickey-Fuller test** applied to the study variables:

Table (01): Results of the Dickey-Fuller test for the study variables.

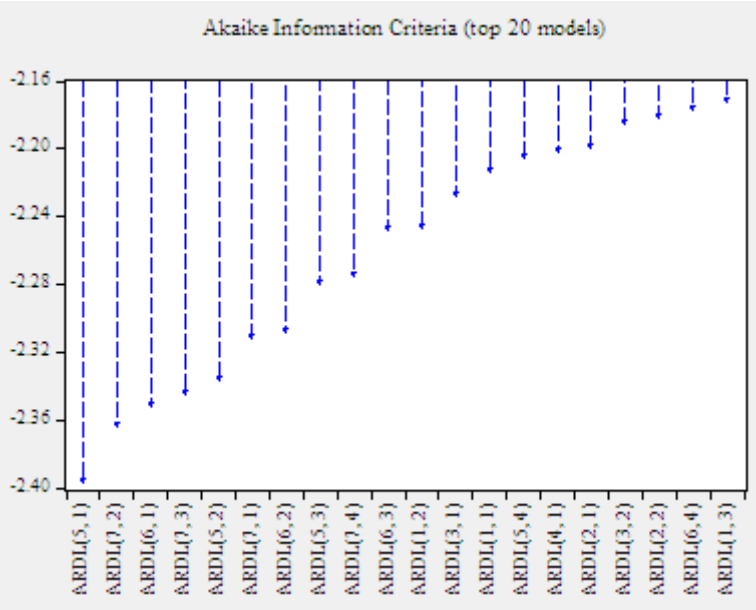
Order	**First Difference**			**Level**			**Series**	
	Trend & Intercept	Intercept	None	Trend & Intercept	Intercept	None		
I(1)	-5.697	-4.907	-3.358	-2.154	-4.267	4.852	$LGDP_t$	
I(1)	-6.112	-4.318	-2.155	-2.708	-4.159	3.578	LG_t	
	-4.296	-3.670	-2.644	-4.284	-3.661	-2.641	**1%**	**Tabulated Critical Values**
	-3.568	-2.963	-1.952	-3.562	-2.960	-1.952	**%5**	
	-3.218	-2.621	-1.610	-3.215	-2.619	-1.610	**%10**	

Source: Prepared by the researchers based on the outputs of EVIEWS 10 software

From the table above, we find that the results of the Dickey-Fuller test for the variables in their logarithmic form indicate that the study variables $LGDP_t$ and LG_t contain a unit root at their original level, and they become stationary after taking the first difference.

2- **Determining the Optimal Lag Lengths for the Variables Included in the ARDL Model Estimation:** To determine the optimal number of lags, the Akaike Information Criterion (AIC) is used, where the lag lengths that yield the lowest value of this criterion are selected.

Figure (02): The 20 Best ARDL Models According to the Akaike Criterion.



Source: EViews 10 Output.

The above figure shows the best 20 models in terms of the lowest value of the Akaike criterion, and the best model among them is the **ARDL (5,1)** model.

3- **Bounds Test:**

From the table below, we find that the calculated F-statistic, which equals 6.88, is greater than the upper bound value at the 1% significance level (6.76). Therefore, the alternative hypothesis is accepted, indicating the existence of a long-run equilibrium relationship between GDP and public expenditure in Algeria during the study period. Consequently, a cointegrating relationship exists between the variables.

Table (03): Results of the Bounds Test

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
		Asymptotic: n=1000		
F-statistic	6.886799	10%	3.02	3.51
k	1	5%	3.62	4.16
		2.5%	4.18	4.79
		1%	4.94	5.58
Actual Sample Size	28	Finite Sample: n=35		
		10%	3.223	3.757
		5%	3.957	4.53
		1%	5.763	6.48
		Finite Sample: n=30		
		10%	3.303	3.797
		5%	4.09	4.663
		1%	6.027	6.76

Source: EViews 10 Output.

4- **Estimation of the Long-Run and Short-Run Model Parameters and the Error Correction Term:**

After confirming the existence of a long-run equilibrium relationship between GDP and public expenditure in Algeria, we proceed to estimate the **ARDL model parameters** for both the long and short run, as well as the **Error Correction Term (ECM)**.

This estimation includes the lagged time series incorporated in the model along with the error correction term. The estimation results are as follows:

Table (04): Long-Run Parameter Estimates of the ARDL Model.

Levels Equation
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LG	0.708876	0.076493	9.267198	0.0000
C	3.706366	0.733481	5.053116	0.0001

EC = LGDP - (0.7089*LG + 3.7064)

Source: EViews 10 Output.

The **Error Correction (EC)** equation can be derived as follows:

$$EC = LGDP_t - (3.7064 + 0.7089 \cdot LG_t)$$

Table (05): Results of the Error Correction Model (ECM) Estimation for the ARDL Model

ARDL Error Correction Regression
Dependent Variable: D(LGDP)
Selected Model: ARDL(5, 1)
Case 2: Restricted Constant and No Trend
Date: 04/24/24 Time: 21:19
Sample: 1990 2022
Included observations: 28

ECM Regression
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LGDP(-1))	-0.157492	0.147260	-1.069480	0.2976
D(LGDP(-2))	-0.303731	0.151284	-2.007690	0.0584
D(LGDP(-3))	-0.208649	0.157858	-1.321755	0.2012
D(LGDP(-4))	-0.377348	0.184844	-2.041442	0.0546
D(LG)	0.561236	0.138246	4.059706	0.0006
CointEq(-1)*	-0.477513	0.100166	-4.767225	0.0001

Source: EViews 10 Output.

From the results of the Error Correction Model estimation, it is observed that there is a strong consistency in terms of **significance levels** and **sign directions** between the short-run parameter estimates and the long-run parameter estimates.

5- Model Diagnostics:

5-1- Economic Evaluation:

a- Evaluation of the Estimated Parameters of the Long-Run and Short-Run

Models:

Based on the ARDL model estimation results presented in Tables (03) and (04), we can conclude the following:

The coefficient of **LGt** indicates a **positive and significant relationship** between public expenditure and GDP in Algeria in both the long and short run.

The **long-run elasticity** of GDP with respect to public expenditure is **0.7089**, meaning that a 1% increase in public expenditure leads to a **0.7089% increase in GDP** in the long run.

In contrast, the **short-run elasticity** of GDP with respect to public expenditure is **0.5612**, implying that a 1% increase in public expenditure results in a **0.5612% increase in GDP** in the same year.

b- Evaluation of the Unrestricted Error Correction Model (ARDL-ECM):

From the Error Correction Model, we find that the estimated parameters are largely consistent with the long-run estimates in terms of **signs** and **statistical significance**.

The **Error Correction Term (COINT EQ(-1))** reflects the **speed of adjustment** from the short run to the long run. This coefficient is expected to be **negative and statistically significant** to confirm the existence of a long-run equilibrium relationship between the study variables.

According to the estimation results, the value of this coefficient is **-0.4775**, which is negative and significant, indicating that **about 47.75% of the short-run disequilibrium is corrected each year**. Consequently, **a full adjustment (100%) would take approximately 2.094 years**.

Based on the statistical criteria, the estimated **ARDL (5,1)** model is generally statistically acceptable, as most of its estimated parameters are **statistically significant** according to the **Student's t-test** at the significance level of $\alpha = 5\%$, While the value of the **adjusted coefficient of determination (Adjusted R²)**, which equals $\overline{R}^2 = 0.9938$ indicates the high explanatory power of this model, meaning that the independent variables explain **99.11%** of the variations in GDP in Algeria during the study period. Moreover, the **Fisher statistic**, which equals **465.40**, confirms the **overall statistical significance** of the estimated model.

Table (06): Statistical Indicators and Criteria of the Estimated ARDL Model

R-squared	0.993898	Mean dependent var	9.095772
Adjusted R-squared	0.991763	S.D. dependent var	0.775097
S.E. of regression	0.070347	Akaike info criterion	-2.235804
Sum squared resid	0.098973	Schwarz criterion	-1.855174
Log likelihood	39.30125	Hannan-Quinn criter.	-2.119441
F-statistic	465.4051	Durbin-Watson stat	1.746589
Prob(F-statistic)	0.000000		

Source: EViews 10 Output.

5-3- Econometric Evaluation:

After estimating the ARDL model parameters for both the long and short run, and after performing the economic and statistical diagnostics, we proceed to conduct the following **Diagnostic Checking Tests**:

Table (07): Results of the Model Diagnostic Tests

BGLM	ARCH	Jarque Bera	RESET
F – statistic = 1.129	F – statistic = 1.752	J. B = 0.4214	F – statistic = 1.759
Prob. F(2.18) = 0.3450	Prob. F(2.23) = 0.1956	Probability = 0.8100	Prob. F(2.18) = 0.2004

Source: Prepared by the researchers based on EViews 10 output.

The results of the model diagnostic tests are as follows:

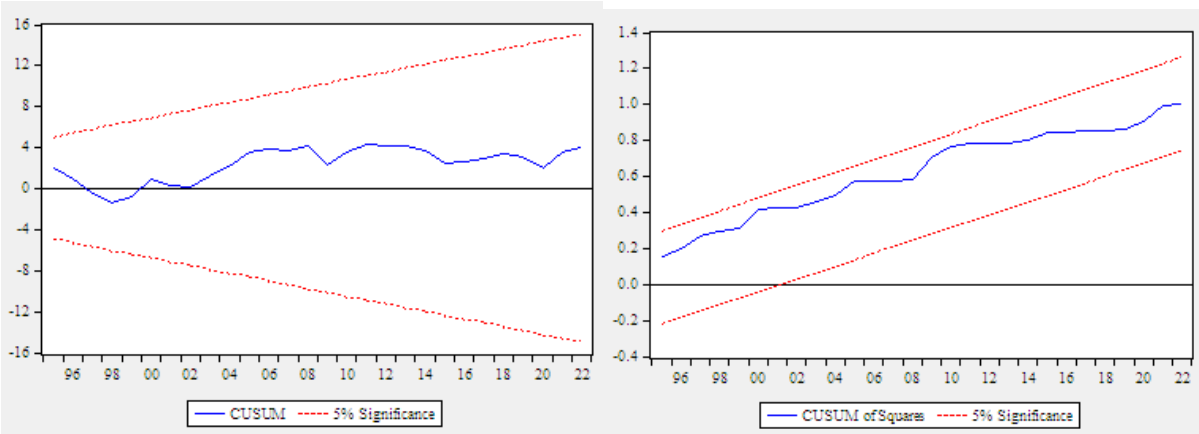
- The **BGLM statistic** indicates the absence of **autocorrelation** in the residuals.
- The **ARCH test** result shows no problem of **heteroscedasticity**, as the **p-value** is **0.19**, which is greater than the 5% significance level, confirming the absence of variance instability.
- The **JARQUE-BERA (JB) statistic** indicates that the residuals follow a **normal distribution**, with a **p-value** of **0.42**, greater than the 5% significance level.
- The **RESET test statistic** confirms the **correct functional form** of the estimated model, as the **p-value** is **0.20**, higher than the 5% significance level. Therefore, the null hypothesis that the model is correctly specified is accepted.

Structural Stability Tests of the Model Parameters:

To verify the absence of **structural changes** in the estimated model over time, the following two tests are used:

- **Cumulative Sum of Recursive Residuals (CUSUM) Test**
- **Cumulative Sum of Squares of Recursive Residuals (CUSUMSQ) Test**

Figure (03): Results of the Structural Stability Tests for the Model Parameters



Source: EViews 10 Output.

It is evident from the above figure that both the **CUSUM** and **CUSUMSQ** statistics for this model lie **within the critical bounds** at the 5% significance level. This indicates **stability and consistency** in the model estimates between the long-run

and short-run results, meaning that the estimated parameters of the **Unrestricted Error Correction Model (UECM)** are **structurally stable** throughout the study period.

4. Conclusion:

This study aimed to analyze and measure the impact of public expenditure on economic growth in Algeria over the period 1990–2022, structured around two main axes. The first axis addressed the theoretical literature related to the study variables, exploring the concepts of public expenditure and economic growth, as well as the economic effects of public spending on growth. The second axis examined the relationship between the two variables in the Algerian economy, analyzing their evolution during the study period and applying the Autoregressive Distributed Lag (ARDL) model to measure the effect of a 1% increase in public expenditure on economic growth in both the long and short run.

Theoretical Findings:

- Public expenditure comprises all monetary amounts spent by the government to meet public needs.
- Economic growth is defined as a sustained increase in GDP or gross national income, resulting in a rise in per capita real income.
- Public expenditure affects production and national output through its impact on aggregate demand. An increase in public spending leads to a rise in national income, which amplifies the increase in aggregate demand beyond the initial expenditure due to the multiplier effect.
- Public expenditure also influences output through its effect on the productive capacity of the national economy, either directly or indirectly, by enhancing both the quantity and quality of production factors.

Empirical Findings:

- Public expenditure in Algeria during the study period was closely linked to fluctuations in global oil prices.
- Rising oil prices in the early 21st century encouraged the state to implement large-scale public spending programs, particularly investing in the construction and public works sectors.
- The main goal of the expansionary fiscal policy during the study period was to achieve and sustain economic growth.
- Despite substantial public spending, economic growth during the study period remained fragile and failed to meet expectations, as evidenced by its decline following drops in oil prices.
- The Bounds Test in the ARDL model confirmed the existence of a long-run equilibrium relationship between public expenditure and economic growth in Algeria, supporting the first hypothesis.
- Long-run ARDL estimates indicated a positive and significant effect of public

expenditure on GDP: a 1% increase in public spending leads to a 0.7089% increase in GDP, confirming the second hypothesis.

- Short-run ARDL estimates also showed a positive and significant effect, where a 1% increase in public expenditure results in a 0.5612% increase in GDP, supporting the third hypothesis.
- The error correction term was negative and significant (-0.4775), indicating the existence of a long-run equilibrium relationship. About 49.23% of short-run deviations are corrected within one year, implying full adjustment takes approximately two years.

Policy Implications and Recommendations:

- Prudent management of oil revenues over the long term is essential to mitigate the risks associated with oil price volatility. Given the economy's reliance on oil, it is crucial to diversify sources of economic growth by continuing to stimulate non-hydrocarbon sectors, such as manufacturing and small- and medium-sized enterprises.
- Enhancing the flexibility of the productive sector, especially in the industrial and agricultural sectors, to align with substantial public spending and reduce the leakage of public funds abroad in the form of imports of goods and investment equipment.
- Considering that oil revenues are the primary source of public finance and are highly dependent on oil prices, it is necessary to restructure Algeria's public revenue system, reduce reliance on oil taxation, and strengthen tax administration to ensure more stable and sustainable public financing.

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