Public Capital Productivity in the Algerian Economy: Between the Imperative of Expansion and the Constraints of Absorptive Capacity

Productivité du capital public dans l'économie algérienne : entre l'impératif d'expansion et les contraintes de capacité d'absorption

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Abstract:

This study examines the impact of public capital spending on GDP growth in Algeria, given the government's reliance on a spending multiplier policy to stimulate the economy. The study employs time series analysis, the Johansen cointegration test, and the Granger causality test.

The results show cointegration among the variables but no causal relationship between capital spending and GDP growth.

Keywords: *Public Capital Productivity; GDP; Gross Domestic Product; capital expenditure.*

Jel Classification Codes : C32 ; E22 ; E62 ; 047 ; H54.

Résumé:

Cette étude examine l'impact des dépenses d'investissement public sur la croissance du PIB en Algérie, compte tenu de la politique gouvernementale d'augmentation des dépenses visant à stimuler l'économie. Elle utilise le test de cointégration de Johansen et le test de causalité de Granger.

Les résultats montrent une cointégration, mais aucune relation de causalité, entre les dépenses d'investissement et la croissance du PIB.

Mots clés*: Productivité du capital public ; PIB ; Produit intérieur brut ; dépenses d'investissement*

Jel Classification Codes : C32 ; E22 ; E62 ; 047 ; H54.

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1. INTRODUCTION

Analyzing the impact of capital expenditure on Algeria's gross domestic product (GDP) is of considerable importance, as it goes to the core of the country's economic policy, Capital outlays constitute the main engine of macroeconomic dynamics in Algeria, given the structural reliance of the economy on government spending to stimulate markets, upgrade infrastructure, and expand productive capacity, Understanding the relationship between the scale and composition of this expenditure and the pace of GDP growth makes it possible to assess the effectiveness of public resource allocation, to evaluate the efficiency and efficacy of successive fiscal policies and development programs, and to determine whether public investment spending generates sustainable growth or merely provides a transitory boost to aggregate demand without durable structural effects.

The relevance of examining the impact of capital expenditure on GDP is further heightened by the fact that a large share of the capital budget is financed through hydrocarbon revenues. Such analysis helps policymakers identify structural distortions, including a low marginal efficiency of capital and the leakage of public spending into imports, thereby informing a reorientation of expenditure policies toward higher-yield projects, reducing waste and corruption, and strengthening the contribution of non-hydrocarbon sectors to growth, in line with the broader objective of economic diversification.

1.1 Research problems:

Based on the preceding analysis, this study seeks to answer the following main research question:

What is the impact of capital expenditures (public investment) in the Algerian on GDP performance during the period (1980-2024)?

1.2 Research hypothesis:

To address the research problem, the study proposes the following hypothesis:

There is no causal relationship between equipment expenditures and GDP performance in Algeria during the period (1980-2024).

1.3 Significance and objectives of the study:

The significance of this research is rooted in its sharp focus on public capital expenditure in Algeria, the principal instrument for stimulating growth, enhancing infrastructure, and expanding productive capacity. Beyond its foundational role in infrastructure development, this fiscal outlay functions as an essential counter-cyclical buffer, indispensable for shoring up aggregate demand in an economic environment characterized by limited private sector dynamism. Consequently, state-led investment emerges as the primary determinant of Gross Domestic Product (GDP) growth, effectively setting a de facto floor for economic performance.

More precisely, this study aims to quantify the impact of public capital expenditure on GDP performance in Algeria over the period 1980-2024, The empirical strategy involves first tracing the time-series evolution of both variables. It then proceeds to test for the existence of a long-run equilibrium relationship, or costation, between them.

1.4 Study data:

The empirical investigation relies on annual time-series observations spanning the period 1980-2024, capturing the dynamics of public capital expenditure and Gross Domestic Product (GDP) performance in Algeria.

1.5. Research methodology:

To generate findings that are consistent with the stated objectives of the study, the analysis adopts a combined descriptive-analytical and econometric strategy, the descriptive-analytical component is employed to trace, characterize, and interpret the evolution of the key variables over time, while the econometric component is used to test for short-rum and long-run equilibrium relationships among these variables and to examine the existence and direction of causal linkages between them.

1.6 Literature Review:

- Hani's (2022) study. "The Impact of Expanded Equipment Spending on Economic Cycles in Algeria (2000-2015)," investigated the nexus between public capital outlays and business cycle dynamics in Algeria, Contextualized by the nation's structural transformations and its acute dependence on hydrocarbon revenues to finance public expenditure, the research employed a descriptive analytical methodology, utilizing a range

of macroeconomic indicators tracking both capital spending and aggregate economic activity.

A central finding of the study was that the expansionary fiscal stance, channeled through equipment spending, proved insufficient to induce a structural transformation toward a diversified productive base capable of dampening cyclical volatility Instead, the macroeconomic impact of this expenditure remained tethered to the volatility of hydrocarbon revenues, a finding that underscores the limited economic efficiency of these outlays and their inefficacy in fostering sustainable growth.

The present analysis diverges from Hani (2022) by shifting the empirical focus from business cycle correlation to the direct measurement of fiscal efficacy, rather than concentrating on cyclical patterns, this research employs a formal econometric framework-comprising unit root tests, cointegration analysis, and causality tests to formally estimate the marginal efficiency of equipment expenditure and its impact on GDP growth This approach allows for a precise quantitative assessment of the growth-enhancing effects of public investment, thereby providing a more granular estimate of its effectiveness as a policy.

- Gharbi et al. (2022) focused specifically on the dichotomy between operating and capital expenditures within the Algerian budget structure for the period 2000-2020, Utilizing an Autoregressive Distributed Lag (ARDL) bounds testing approach, the study assessed the dynamic impact of public capital accumulation on aggregate output. The empirical findings reveal a statically significant positive elasticity of GDP with respect to capital expenditure, confirming that state-led infrastructure investment functions as a robust determinant of economic growth in both the short-run dynamics and the long-run equilibrium

1.7 Definition of the study variables

This study focuses on two core variables:

- **Gross Domestic Product (GDP) (N)**:

  The rationale for selecting GDP as the dependent variable in this study rests on its status as the most widely employed macroeconomic aggregate for gauging economic performance and the level of real economic activity, GDP captures the total value of goods and services produced

within an economy over a given period and as such, encapsulates the outcome of the interplay among the various components of aggregate demand- namely consumption investment, government expenditure, and the external sector, Adopting this variable thus permits a comprehensive assessment of the aggregate impact of public capital expenditure on the trajectory of economic growth.

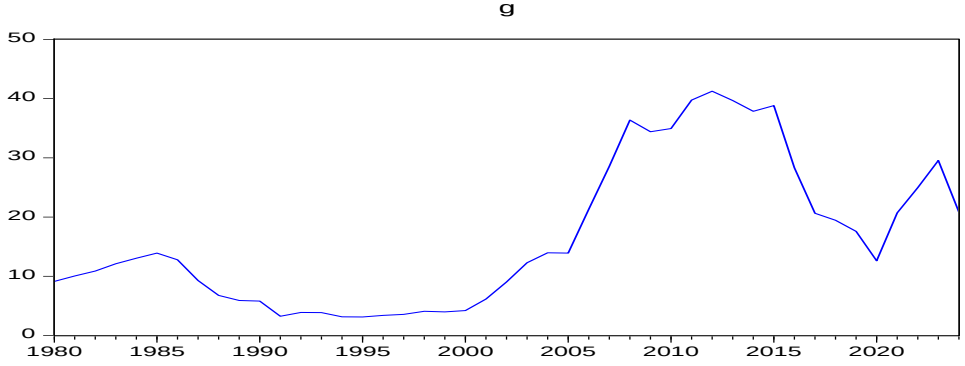
- **public equipment expenditure (G)**:
  The rationale for adopting public capital expenditure (dépenses d'équipement) as the explanatory variable in this study lies in its role as the cornerstone of public investment and the state's principal instrument for establishing and upgrading physical infrastructure-roads, ports, airports, housing stock, and productive and service-sector facilities-while simultaneously expanding the economy's installed productive capacity, Capital outlays constitute the most direct fiscal expression of the government's developmental commitments; analyzing their behavior therefore permits an evaluation of the effectiveness of public investment policy in stimulating output growth and inducing structural transformation, as distinct from merely tracking current expenditure of a consumptive nature.

2. Theoretical framework of the study

2.1 The Evolution of Public Capital Expenditure in Algeria: 1980-2024

Since 1980, the trajectory of capital expenditure has exhibited a series of distinct structural phases extending through 2024, delineated as follows: (Finance Acts, 1980 et seq)

Fig N° 1: Evolution of Public Capital Expenditure in Algeria: 1980-2024



Source: Author's elaboration based on World Bank data reports. Available at:

www.worldbank.org.

The Early 1980s: In the decade's initial years, the persistence of elevated capital outlays was largely underpinned by hydrocarbon windfalls accumulated during the 1970s, Throughout this period, fiscal policy remained committed to a strategy of state-led heavy industrialization, executed within the constraining framework of rigid Five-Year Development Plans.

Phase II 1990-1999: The decade known as the "Black Decade" was characterized by a severe contraction in public investment, precipitated by the exigencies of a Structural Adjustment Program negotiated with the International Monetary Fund (IMF), During this period, the state was forced to prioritize current expenditure specifically the servicing of public sector wages and security-related outlays-at the expense of development Consequently, the effective freezing of public investment resulted in a substantial degradation of the nation's physical infrastructure, marking this era as the historical nadir for public capital expenditure.

Phase III 2000-2014: In sharp contrast, the subsequent fourteen-year period represented a paradigm shift toward aggressive fiscal expansion, driven by three successive development frameworks Initially, thereby facilitating the execution of macro- scale projects, including the East-West Highway, university infrastructure, hydraulic dams, and mass housing initiatives.

Phase IV 2015-2020: The mid-2014 collapse in global oil prices necessitated an abrupt pivot toward a policy of "rationalizing expenditure", Because current spending components-particularly subsidies and wages exhibited downward rigidity, the burden of fiscal consolidation fell disproportionately upon the capital budget, As the government moved to suspend or cancel non-priority projects, capital expenditure contracted significantly, ending the previous era's expansionary momentum.

Phase V 2021-2024: Buoyed by a recovery in hydrocarbon revenues, the period spanning 2021 to 2024 indicates a resumption of the upward trajectory in public capital expenditure by 2023, the fiscal framework had been recalibrated to prioritize strategic sectors, specifically mining and rail transport (Gharbi, Y. S. L., Mahfoudi, F., & Chellih, T. (2022)).

2.2 Analysis of the Evolution of Algeria's GDP (1980-2024)

Algeria's GDP growth has witnessed several key phases, as follows:

Phase I: Structural Fragility and the Collapse of the Command Model (1980-1989) The period between 1980 and 1989 represents a critical juncture in which the hegemony of a centrally planned economy-predicated almost exclusively on state-directed public investment was exposed to the volatility of global markets While the decade.

ostensibly commenced with macroeconomic buoyancy fueled by elevated hydrocarbon valuations, the trajectory was irrevocably altered by the exogenous shock of the 1986 oil price collapse, although aggregate data indicates an expansion of nominal GDP from USD 42.3 billion to USD 54 billion over the decade, these figures belie the severity of the underlying structural deterioration Ultimately, the precipitous contraction in export revenues during 1986 served as the catalyst for a systemic unraveling, transitioning the nation from managed planning into the nascent stages of a debilitating external debt crisis. (World Bank Open Data - GDP Current USD‹2025).

Phase II: The "Black Decade" and the Imperative of Structural Adjustment (1990– 1999)‹This era is demarcated by the catastrophic convergence of civil insecurity and sovereign financial insolvency, creating what is widely regarded as the nadir of Algeria's modem economic chronology Consequently, the state was compelled to dismantle its centralized economic architecture in favor of market-based modalities, a transition mandated by the strict conditionality of the International Monetary Fund's Structural Adjustment Program as documented in IMF Article IV Consultation Reports, nominal metrics reflected this turmoil, with GDP contracting to a trough of USD 41.2 billion in 1995, However, a critical interrogation of these figures reveals that aggressive currency devaluation served to mechanically compress dollar-denominated valuations, an accounting distortion that effectively obscured the distinct underlying trajectory of real output. (International Monetary Fund (1995-1999)).

Phase III: The "Oil Boom" and State-Led Stimulus Programs (2000-2014) Between 2000 and 2014, Algeria experienced the most pronounced phase of

economic expansion in its post-independence history, an outcome fundamentally underpinned by the escalation of international oil prices to record levels. (Hani, M .(2022)) The macroeconomic regime during this interval was characterized by a deliberately expansionary fiscal stance, the authorities deployed large-scale "Néphates de équipement" (capital expenditure) as the principal policy instrument, implemented through a sequence of Growth Support Plans adopted in 2001, 2005, and 2010, which institutionalized the stimulus programs,In nominal terms, gross domestic product (GDP), expressed in U.S. dollars, rose from USD 54.7 billion in 2000 to a historical peak of USD 213.8 billion in 2014 In parallel, foreign exchange reserves were accumulated to a level exceeding USD 190 billion, a stock of external assets that made possible the early repayment of outstanding external debt obligations. (Office National des Statistiques(2020))

Phase IV: The 2014 Price Collapse and Prolonged Stagnation (2015-2020) In the aftermath of the mid-2014 collapse in hydrocarbon prices, Algeria reverted to a consolidation-oriented fiscal stance, marked by renewed austerity measures and retrenchment of public expenditure.

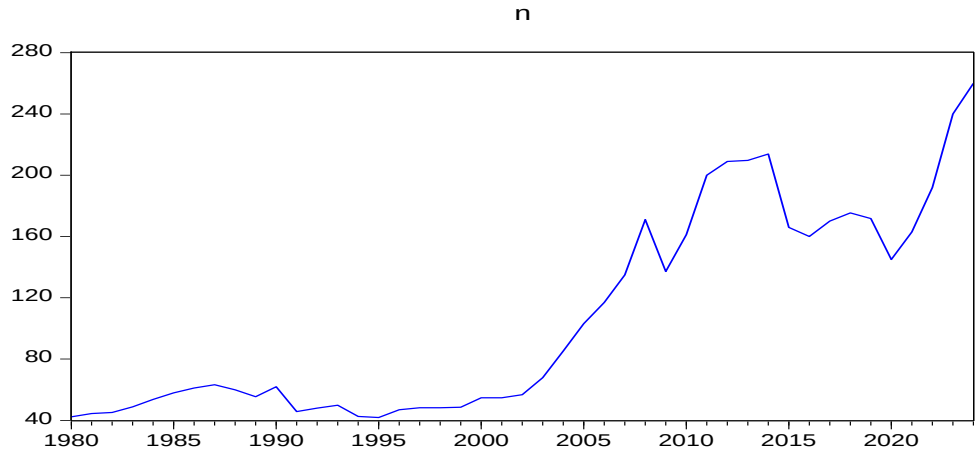
Within this context, the policy framework shifted toward deficit containment strategies (International Monetary Fund 2020).

Phase V: Recovery, Structural Reorientation, and Statistical Rebasing (2021-2024) The years 2021-2024 correspond to a phase in which a rapid post-shock recovery in aggregate activity occurs simultaneously with a methodological redefinition of the officially measured size of the economy.

At the level of the policy regime, the authorities have reoriented their stated strategy toward the promotion of non-hydrocarbon exports, the acceleration of economy-wide digitalization, and the modernization of the national statistical system, including the overhaul of national accounts compilation practices, In nominal terms, gross domestic product (GDP), expressed in U.S. dollars, is reported at USD 191.9 billion in 2022, with projections indicating an expansion to USD 266.8 billion by 2024 an increase that reflects both real and statistical factors. According to the International Monetary Fund, this upward shift is driven by three main elements: elevated natural gas prices, the continued rise of non-oil output, and the adoption by Algeria of a new base year for its national accounts, aligned with prevailing

international statistical standards. (International Monetary Fund (IMF), 2024)

Fig N° 2: The Evolution of Algeria's GDP (1980-2024)



Source: Author's elaboration based on World Bank data reports Available at: www.worldbank.org

3. Testing the relationship between capital (equipment) expenditure and GDP in Algeria (1980-2024)

3.1 Stationarity Analysis of Study Variables: ADF Test Results at the 5% Level (α = 0.05)

Table N°1:. Results of the Augmented Dickey-Fuller test in levels at the significance level (α = 0.05)

Variable	Specification	Calculated t-Statistic	Critical Value (5%)	Inference
N	Intercept & Trend	1.4172	3.5155	Non-stationary
	Intercept	0.4966	2.9297	Non-stationary
	None	1.9115	1.9484	Non-stationary
G	Intercept & Trend	1.7312	3.5180	Non-stationary
	Intercept	1.5476	2.9314	Non-stationary
	None	0.8072	1.9486	Non-stationary

Source: Author's calculations based on Eviews, 7 outputs.

At a significance level of 5% (a = 0.05), the tabulated results for all three

model specifications show that the unit root hypothesis is not rejected for both GDP (N) and public equipment expenditure (G), demonstrating that each series is non-stationary across specifications. Therefore, the enhanced Dickey-Fuller (ADF) procedure should be re-estimated using first difference transformations for the variables under consideration

Table N°2: Results of the Augmented Dickey-Fuller test at the first

Variable	Specification	Calculated t-Statistic	Critical Value (5%)	Inference
N	Intercept & Trend	5.3491	3.5180	stationary
	Intercept	5.2012	2.9314	stationary
	None	4.8986	1.9486	stationary
G	Intercept & Trend	4.0019	3.5180	stationary
	Intercept	4.0762	2.9314	stationary
	None	4.1414	1.9486	stationary

difference, at the significance level (α = 0.05)

Source: Author's calculations based on Eviews, 7 outputs.

At the 5% significance level (α = 0.05), the Augmented Dickey-Fuller (ADF) test fails to reject the null hypothesis of a unit root for both real GDP (N) and public equipment expenditure (G) under all three deterministic specifications-intercept and trend, intercept only, and no deterministic components. This confirms that both series are non-stationary in levels. However, when the test is applied to their first differences, the unit root null is rejected across specifications, indicating that stationarity is achieved at the first difference. Hence, both variables are integrated of order one

3.2. Cointegration analysis according to the Johanson methodology.

As elucidated by Engle and Granger (1987), the theory of cointegration addresses the capacity for a stationary linear combination to emerge from multiple time series that are, in their level forms, inherently non-stationary. Provided that these variables share an identical order of integration-necessitating an equivalent degree of differencing to achieve stationarity-they

may nonetheless exhibit a cohesive long-rum equilibrium. Within the framework of the resulting cointegrating equation, the idiosyncratic short-run volatilities of the individual series mutually negate one another, thereby ensuring the temporal stability of the weighted relationship between the variables. (Engle, R. F., & Granger, C. W. J. 1987).

Empirically, the identification of cointegration confirms that divergent non-stationary series are tethered to a common long-run equilibrium, notwithstanding their independent stochastic drifting, this structural linkage is sufficient to substantiate the regression specification, thereby ensuring that the estimated parameters represent a true economic relationship rather than a spurious correlation, thus rendering the statistical inference robust. (Granger, C. W. J. 1986).

3.3 Basic requirements for establishing a mutual integration relationship:

The econometric identification of cointegration is contingent upon a dual set of stipulations regarding integration orders and residual behavior. Initially, the variables must be integrated of the same order, a condition met when non-stationary level data requires an identical number of differences to achieve stationarity. Subsequently, the error term generated by the linear regression linking these variables must exhibit stationarity implying an integration order lower than the original series. It is the stationarity of these residuals that identifies the linear combination as a cointegrating equation, thereby confirming a fixed long-run equilibrium.

Given the empirical result that the individual series are integrated of order two- attaining stationarity only after second differencing the subsequent analytical requirement is to investigate the integration order of the residuals. This step is necessary to ascertain whether a stationary linear combination of the non-stationary variables exists, thereby validating the presence of cointegration.

3.4 Testing for Stationarity in the Residuals:

Table (3) shows that the residual series is non-stationary in levels under all three model specifications.

It is therefore necessary to re-test the residuals after taking the first difference.

Table N°3: Test of the stationarity of the residual series at the significance level ($\alpha = 0.05$)

Variable	Model Specification	tt-Statistic	Critical Value (5%)	Outcome
Residuals (*u*)	None	4.0436	1.9503	stationary
	Intercept	3.9085	2.9458	stationary
	Intercept & Trend	2.9584	2.4808	stationary

Source: Author's calculations based on EXiews 7 outputs.

With the conditions for the Johansen test satisfied, it is imperative to identify the appropriate lag length to ensure the model is correctly specified

3.5. Selection of the Appropriate Lag Length for the VAR Model:

Conceptually, the lag structure functions as a quantitative metric of temporal latency. defining the precise interval required for an exogenous shock originating in the independent variable to propagate through the system and precipitate a measurable response in the dependent variable. From an operational standpoint, the identification of the optimal lag order is predicated on a comparative assessment of competing model specifications; this protocol necessitates the selection of the specific structure that minimizes the values of standard diagnostic metrics, namely the Akaike (AIC), Schwarz (SC), and Hannan-Quinn (HQ) information criteria.

Table N°4: Selection of Optimal Lag Length

Lag	0	1	2	3	4
Log L	-628.865	-592.266	-590.475	-581.746	578.427
LR	NA	178.1388	3.293441	4.36666	*20.35152
FPE	1884086	825153.3	886581.8	7204815	*661941
AIC	23.189	19.298	19.370	18.411	*16.175
SC	23.2578	19.7132	19.8914	19.7926	*18.5048
HQ	23.216	19.599	19.5048	62.0222	*18.3797

Asterisks (*) in the table indicate the lag order preferred by each respective information criterion.
Source: Author's own computations derived from EViews, 7 output.

An examination of the reported criteria reveals that they uniformly identify a lag length of four periods as the optimal specification.

3.6. Empirical Investigation of Long-Run Equilibrium Relationships: On the basis of the foregoing considerations, the Johansen cointegration procedure is applied to the set of study variables. The corresponding empirical outcomes are reported in summarized form in Table (5).

Table 5. Results of the cointegration test for the study variables at the significance level (α =0.05)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.
None *	0.284931	19.58790	15.49471	0.0114
At most 1	0.143003	6.172858	3.841466	0.0130

Source: Author's calculations based on ENiema, 7 outputs.

With reference to Table (5) and more specifically, to the second row associated with the hypothesis (r=1) the Johansen trace statistic at this stage is employed to assess the following hypotheses:

• Null hypothesis (Ho): the cointegration rank is equal to one; that is, there exists exactly one cointegrating vector.

• Alterative hypothesis (H.): the cointegration rank exceeds one; in other words, there is more than one cointegrating vector.

For purposes of inference, the estimated trace statistic is evaluated against the corresponding tabulated critical value in accordance with the standard decision rule:

When the computed trace statistic exceeds the critical value, the null hypothesis (Ho) is rejected in favour of the alternative

implying the existence of more than one cointegrating relation.

Conversely, when the trace statistic is lower than the critical value, the null hypothesis (Ho) is not rejected and the alternative (H_1) is ruled out, which is interpreted as evidence in favour of a single cointegrating vector.

In our case, the trace statistic (6.17) is greater than the 5% critical value (3.84), Trace statistic = 6.17>3.84 critical value

Consequently, the null hypothesis predicated on the existence of a unique cointegrating vector-is statistically untenable and is therefore rejected. Conversely, the empirical data validates the alterative hypothesis at the 5% significance threshold (a=0.05), thereby confirming the presence of multiple cointegrating relationships within the system.

The inference is further substantiated by the Maximum Eigenvalue statistic, the relevant estimates of which are reported in the table below:

Table 6. Outcomes of the Maximum Eigenvalue Cointegration Test at the 5% Significance Level

Hypothesized		**Max-Eigen**	**0.05**	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.284931	13.41504	14.26460	0.0678
At most 1	0.143003	6.172858	3.841466	0.0130

Source: Author's calculations based on Eviews, 7 outputs.

Table (6) refines the preceding evidence by showing that, for the case (r=1), the Maximum Eigenvalue statistic (6.17) exceeds its 5% critical value (3.84).

Max-Eigen statistic = 6.17> 3.84 = critical value Max.

On this basis, the model leads to rejection of the null hypothesis (H_0), which posits the existence of a single cointegrating vector among the variables, in fawx of the alternative hypothesis (H_1), which implies more than one cointegrating relationship, at the 5% significance level (α =0.05)

Taken together, the outcomes of both the Trace and Maximum Eigenvalue tests thus provide consistent evidence for the presence of more than one cointegrating vector at (α =0.05).

Taken together, the results of both the Trace and Maximum Egenvalue tests consistently indicate the presence of exactly one cointegrating vector at (α =0.05) between Gross Domestic Product and the time series describing the evolution of public equipment expenditure.

Having established the existence of a long-rum equilibrium relationship between the two variables under Study-Gross Domestic Product N and public equipment expenditure G.

With the long-run equilibrium having been rigorously established, the investigation must now pivot toward a granular assessment of the dynamic short-rum causality governing the interplay between these variables.

4. Testing for Granger Causality between Gross Domestic Product and Public Equipment Expenditure:

The Granger causality test evaluates whether lagged realizations of one variable provide additional explanatory power for another variable beyond that contained in its own past values, and, in doing so, facilitates the identification of the lag structure through which such effects are transmitted.

Against the backdrop of the foregoing empirical results, the analysis now turns to the specification and testing of two competing hypotheses. These are expressed in terms of a null and an alternative hypothesis, which can be stated as follows:

- Null hypothesis (Ho): no causal relationship exists.
- Alternative hypothesis (Hi): a causal relationship exists.

The empirical outcomes of the Granger causality tests for the variables under investigation are presented in Table (7) below.

Table (7). Granger causality test results between the study variables

Null hypothesis	Obs.	F-statistic	Prob.
N does not Granger-cause G	41	0.03884	0.9970
G does not Granger-cause N	41	1.37112	0.2659

Source: Author's calculations based on Eiews, 7 outputs.

From Table (7), the following can be observed:

- The empirical evidence from the Fisher F-statistic, computed at 0.03, demonstrably fails to surpass the relevant critical threshold at the 5% significance level within a four-lag framework. This statistical non-significance is further corroborated by the associated probability value of 0.99, which categorically exceeds the (α =0.05) boundary. Consequently, the inferential framework mandates the retention of the null hypothesis (Ho), thereby rejecting the alterative (H_1) and concluding that variations in Gross Domestic Product (N) do not possess statistically significant Granger-causal power over the trajectory of Public Equipment Expenditure (G).

- The empirical evidence from the Fisher F-statistic, computed at 1.37, demonstrably fails to surpass the relevant critical threshold at the 5% significance level within a four-lag framework. This statistical non-significance is further corroborated by the associated probability value of 0.26, which categorically exceeds the (α =0.05) boundary. Consequently, the inferential framework mandates the retention of the null hypothesis (Ho), thereby rejecting the alternative (H_1) and concluding that variations in Public Equipment Expenditure (G) do not possess statistically significant Granger-causal power over the trajectory of Gross Domestic Product (N).

5. CONCLUSION:

This study aimed to investigate the impact of public equipment spending in Algeria on GDP during the period 1980-2024. The following are the main empirical findings:

- Time series analysis shows that all variables are unstable at their initial levels, but become stable after the first difference. Therefore, the two series are first-order complementary, providing the necessary conditions for applying cointegration, techniques.
- The Johansen cointegration, test indicates a statistically significant long-term equilibrium relationship between public equipment spending and Gross Domestic Product to level of 5%
- Granger's causal results reveal no two-way causal relationship between equipment expenditures and GDP at level 5%.
- Consequently, the empirical evidence corroborates the central hypothesis, demonstrating that, at standard levels of statistical significance, there exists no causal nexus between equipment expenditure and Gross Domestic Product in the short run.
- The marginal productivity of public capital in Algeria is currently poised at a critical juncture. It is caught between the exigency of fiscal expansion necessary to transcend the limitations of a rentier growth model and foster structural diversification and the binding constraints of absorptive capacity. The latter poses a substantial risk, potentially rendering capital accumulation inefficient or yielding suboptimal investment returns. The paramount challenge lies not in the scarcity of fiscal resources, but in the efficiency of their conversion into productive public capital stock. This necessitates rigorous institutional reform and governance enhancement. Furthermore, the velocity of capital accumulation must be aligned with the economy's effective capacity to absorb, operate, and maintain new infrastructure.

  Ultimately, the analysis suggests that Algeria's expansionary fiscal stance has encountered the law of diminishing marginal returns. Persisting with physical capital deepening, absent a concomitant strengthening of institutional infrastructure, will serve only to exacerbate fiscal disequilibria and deplete sovereign buffers.

Recommendations:

On the basis of the empirical findings, the study advances the following recommendations:

The existing project appraisal and selection architecture should be overhauled, as it remains insufficiently anchored in disciplined economic evaluation.

A revised framework ought to mandate robust cost-benefit analysis, formal estimation of productivity effects, and explicit screening for complementarities that facilitate private sector integration.

Persistent deficiencies in public procurement governance warrant corrective action. Specifically, transparency safeguards should be tightened and enforcement strengthened, while ex post project evaluation must be institutionalized through systematic monitoring, clearly specified performance benchmarks, and legally credible accountability mechanisms for underperformance and cost overruns.

Exclusive reliance on physical infrastructure accumulation is unlikely to generate sustained efficiency gains under prevailing institutional constraints. Public investment should therefore be rebalanced toward human capital and institutional capital formation in tandem

with infrastructure spending, given that the productivity of the physical capital stock is conditional on the effectiveness of the administrative, regulatory, and operational environment that governs its deployment and maintenance.

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