The Relationship of Economic Growth to Government Expenditure in Algeria (1990-2022) - An Econometric Study According to Wagner's Law -

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Abstract:
This study examines whether Wagner's Law holds in Algeria over 1990–2022 using six alternative formulations. Four specifications confirm a significant long-run relationship, with income elasticities exceeding unity. The Pryor model proves most robust, revealing cointegration between real government consumption and GDP, with approximately 26% of short-run disequilibrium corrected annually. Causality runs strictly from GDP to government expenditure, supporting Wagner's Law and rejecting the Keynesian view, with important implications for fiscal policy and expenditure management in Algeria.
Keywords: *Wagner's Law; Government Expenditure; Economic Growth; Cointegration; Algeria.*

1. INTRODUCTION

The relationship between government spending and GDP is one of the most debated topics in economic literature, with numerous theories proposed by various schools of thought to explain the expansion of public spending. Two main approaches have emerged: the Keynesian hypothesis, which emphasizes the role of government spending in influencing economic activity, and the Wagner hypothesis, which posits a direct relationship

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between government activity and public spending as economies develop (Wagner A., 1883).

The fundamental difference between the Keynesian and Wagnerian approaches lies in the direction of causation. Keynesian theory suggests that causation flows from government spending to economic growth. In contrast, Wagner's law posits that economic growth is the primary driver of increased government spending (Erguigue, 2023, p. 3), i.e., the opposite direction. Because of the mathematical ambiguity, several versions of mathematical models have emerged to express Wagner's hypothesis. These versions differ in the variables of the relationship and the economic and financial framework used (Musgrave, 1963).

1.1. Algerian Context

In the Algerian context, government spending policy has been a crucial fiscal tool for achieving economic growth since independence in the 1960s. The country inherited a devastated and exhausted economy, making it difficult for private institutions to manage the unstable situation. Government intervention became the optimal solution for building a solid economic foundation. While the growth of the public sector significantly boosted economic activity, it also faced challenges such as waste, inefficiency, and corruption. Furthermore, the Algerian economy was subjected to shocks from the 1986 oil crisis and the economic reforms of the 1990s, leading to a relative decrease in public spending levels and a redefinition of the state's role (Atmania & Ait Yahia, 2021).

1.2. Research Problem

The research problem that this study seeks to address is:

Can Wagner's Law explain the high levels of public spending in the Algerian economy?

Wagner's Law has been studied in Algeria in several empirical studies, and there has been a discrepancy in the evidence regarding its validity. This is mainly due to differences in methodology, time period, and model specifications.

1.3. Research Hypotheses

In this study, we attempt to test two hypotheses regarding the relationship between public spending and economic growth in Algeria using time series data from 1990 to 2022:

- **H_1 (Wagner's Law Hypothesis):** This hypothesis states a unidirectional causal relationship, both in the short and long run. This hypothesis reflects Wagner's view that government spending is an endogenous variable driven by economic growth, and that economic growth results in increased public spending.
- **H_2 (Keynesian Hypothesis):** This hypothesis states a unidirectional causal relationship from public spending to economic growth in both the short and long run. This hypothesis reflects the Keynesian view that public spending acts as a catalyst for economic growth.

1.4. Research Significance

The significance of this study lies in its use of various econometric techniques, including unit root tests, stability tests, cointegration analysis, error correction models, and causality tests, to examine six versions of the Wagner hypothesis in the Algerian context. The research aims to determine the nature and direction of the relationship between real GDP and real government spending in Algeria (Atmania & Ait Yahia, 2021).

1.5. Literature Review

Various empirical studies have tested Wagner's Law, which explores the long-term relationship between government spending and economic growth. Researchers have applied this hypothesis in diverse economic contexts using a range of statistical and econometric techniques, including cointegration tests, error correction models (ECM), and Granger causality tests.

a. Studies on Algeria: Several studies have tested Wagner's Law specifically for the Algerian economy, with varying results depending on the time period, data frequency, and econometric methodology employed.

- **Djamil and Akriche (2022)** tested Wagner's Law against the Keynesian hypothesis using annual data from 1962 to 2016, accounting for structural breaks in the Algerian economy. Applying the ARDL bounds testing approach and VECM Granger causality test with Pryor's formulation,

they found strong empirical support for Wagner's Law. Their results indicated income elasticity greater than unity and unidirectional causality running from GDP to government consumption expenditure in both the long and short run.

- **Atmania and Ait Yahia (2021)** examined five versions of Wagner's Law over the period 1967–2018 using the ARDL bounds testing approach and pairwise Granger causality tests. Their findings confirmed that Wagner's Law holds in Algeria, but only under the Pryor specification. They identified a cointegrating relationship and unidirectional causality from GDP to government spending, supporting the validity of Wagner's hypothesis for the Algerian context.
- **Ziane and Hhi (2021)** investigated the relationship for 1980–2019 using the Peacock–Wiseman and Gupta models with Engle-Granger cointegration methodology and Granger causality tests. Their results confirmed the validity of Wagner's Law in Algeria, demonstrating a long-run equilibrium relationship between public expenditure and economic growth.
- **Ben Jeddou and Ramli (2020)** tested all six versions of Wagner's Law for 1990–2017 using the Engle-Granger cointegration approach and Granger causality tests. They found evidence of a long-run equilibrium relationship only under the Mann formulation (the modified Peacock-Wiseman version), with unidirectional causality from GDP to the share of government expenditure in GDP.

b. International Evidence: moving beyond Algeria, the international literature presents similarly mixed findings, with considerable variation across countries, time periods, and methodological approaches.

- **Inchauspe et al. (2020)** confirmed Wagner's Law in Indonesia for 1980–2014, identifying unidirectional causality from GDP to government expenditure.
- **Ahmed Abdullah Ibrahim and Mohamed Sharif Bashir (2019)** found no empirical support for Wagner's Law in Sudan using quarterly data and ARDL methodology.
- **Halıcıoğlu (2003)** reported similar negative results for Turkey (1960–2000) using bounds testing and error correction modeling.

These diverse findings highlight that the validity of Wagner's Law is often context-dependent and may be influenced by factors such as the specific period, model specifications, country-specific economic conditions, and structural changes. While some studies confirmed the long-term relationship between government spending and economic growth as proposed by Wagner's Law, others found limited or no supporting evidence. The literature suggests that the relationship between these macroeconomic variables is complex and may require further investigation using different methodological approaches and data sets.

1.6. THEORETICAL FRAMEWORK

Adolf Wagner, a German economist, was the first to identify the phenomenon of increasing public expenditure by observing the growth of public spending in several European countries (Loizides & Vamvoukas, 2005, p. 126) in the 19th century (1892). He noted that government spending increased faster than general economic activity during the pivotal era of European industrialization, leading to what became known as the law of public expenditure elasticity relative to GDP being greater than unity $\eta G, Y = \frac{\partial G}{\partial Y} . \frac{Y}{G} > 1$ (Wagner A., 1883; Henrekson, 1993, p. 410; Wagner & Weber, 1977)

The central idea of Wagner's Law is fascinating because it was one of the first attempts to explain why government spending tends to grow over time in developing economies. It is also called Wagner's Hypothesis (WH) (Masan, 2015, p. 8).

Where he proposed three main reasons for increased government activity: (Al Alshaikh, 2002, p. 136)

- **Industrialization and Modernization:** Public activity replaces private activity during industrial periods, expanding government spending related to administrative tasks and economic regulation.
- **Rise in Real Income**: Increased demand for public services requires state intervention through higher spending on education, health, and essential goods and services.

- **Technological Developments**: Inevitable technological advances and required investments in various activities contribute to increased monopolies, leading to increased state expenditure.

While Wagner didn't present his law in mathematical form, various authors developed at least six different versions that have been empirically tested across many countries. The key interpretations include:

1.6.1 Peacock-Wiseman (1961)

The Peacock-Wiseman (P&W) model of Wagner's Law examines the relationship between real government spending and real economic growth. It proposes that government spending should increase at a higher rate than real GDP, indicating a direct link between economic expansion and public expenditure growth (Magazzino, Giolli, & Mele, 2015, p. 813).

$$ln(RGE)_t = \beta_1 + \beta_2\, ln(RGDP)_t + \varepsilon_t \text{.....(1)}$$

1.6.2 Gupta (1967)

The Gupta model in Wagner's Law focuses on real government spending per capita, examining its growth relative to real GDP per capita. It posits that government spending should increase at a faster rate than real GDP, with the mathematical representation (Ben Jedou & Ramli, 2020, p. 895).

$$ln(RGE/P)_t = \beta_1 + \beta_2\, ln(RGDP/P)_t + \varepsilon_t \text{.....(2)}$$

1.6.3 Goffman (1968):

The Goffman model, an absolute version of Wagner's Law, examines the relationship between real government spending (LnRGE) and real GDP per capita (Ln(RGDP/P)). It posits that as an economy develops, public sector activity will grow faster than per capita income, with the mathematical representation (Babajide, Okunlola, Nwuba, & Lawal, 2020, p. 2).

$$ln(RGE)_t = \beta_1 + \beta_2\, ln(RGDP/P)_t + \varepsilon_t \text{.....(3)}$$

1.6.4 Pryor (1969)

The Pryor model, a relative version of Wagner's Law, analyzes the relationship between government consumption expenditure and GDP. It focuses on the direct link between economic output and government consumption spending, without population adjustments. The model posits that as GDP grows, government consumption increases even faster, with an

elasticity coefficient greater than one. This means for every 1% GDP increase, government consumption expenditure rises by more than 1%, reflecting the expanding role of government services in developing economies (Bazán, Álvarez-Quiroz, & Morales Olivares, 2022, p. 7).

$$ln(RGCE)_t = \beta_1 + \beta_2\, ln(RGDP)_t + \varepsilon_t \ldots\ldots.(4)$$

1.6.5 Musgrave (1969)

The Musgrave model of Wagner's Law uses the nominal government expenditure share in nominal GDP as the dependent variable, with real GDP per capita as the independent variable. It posits that government spending should increase more rapidly than real GDP (Balaban & Živkov, 2021, p. 109).

$$ln(NGE/NGDP)_t = \beta_1 + \beta_2\, ln(RGDP/P)_t + \varepsilon_t \ldots\ldots..(5)$$

1.6.6 Mann (1980)

The Mann model employs a novel approach by utilizing the government spending share in nominal GDP (Ln (NGE/NGDP)) as the dependent variable, replacing the traditional real government spending metric. This specification regresses the government spending share against real GDP (LnRGDP), with the key constraint that the resulting elasticity must be greater than zero (Toda & Yamamoto, 1995, p. 409).

$$ln(NGE/NGDP)_t = \beta_1 + \beta_2\, ln(RGDP)_t + \varepsilon_t \ldots\ldots\ldots.(6)$$

Table N⁰(01) :: Wagner's Law - Models and Versions

N°	Release Original version	Specification	Modulus of elasticity
1	Peacock & Wiseman (1961)	LnRGE = f(LnRGDP)	$\beta_2 > 1$
2	Gupta (1967)	Ln(RGE/P) = f(Ln(RGDP/P))	$\beta_2 > 1$
3	Goffman (1968)	LnRGE = f(Ln(RGDP/P))	$\beta_2 > 1$
4	Pryor (1969)	LnRGCE = f(LnRGDP)	$\beta_2 > 1$
	Subsidiary version		
5	Musgrave (1969)	Ln(NGE/NGDP) = f(Ln(RGDP/P))	$\beta_2 > 1$
6	Mann (1980)	Ln(NGE/NGDP) = f(LnRGDP)	$\beta_2 > 0$

Source:(Verma S. A., 2010)

2. METHODOLOGY:

2.1. Data and Variables

The study examines the causal relationship between government spending and GDP in Algeria using annual data from 1990-2022. This period was chosen due to Algeria's transition to a market economy in 1990, and 2022 was the latest year with available World Bank Development Indicators data. All data series are expressed in natural logarithms per Wagner's Law.

2.2. Econometric Framework

The study employs a comprehensive methodology combining descriptive and econometric analysis techniques. The research utilizes EViews 12 econometric software, with results reported at conventional significance levels (1%, 5%, and 10%). The analytical framework includes:

2.2.1. Unit Root Tests

The methodological challenges in testing Wagner's Law are complex, particularly in time-series analysis. Researchers have highlighted the critical importance of checking data stationarity and using modern econometric techniques to avoid spurious regressions and accurately estimate short-term and long-term effects (EViews, 2024).

Stationarity is examined using the Augmented Dickey-Fuller (ADF) (Mushtaq, 2011) test and the Phillips-Perron (PP) test (Phillips & Perron, Testing for a unit root in time series regression, 1988, pp. 335-346). These tests are conducted at different levels (level form, first-difference form) and with or without a trend, evaluating the null hypothesis of a unit root against the alternative of stationarity.

2.2.2. Lag Selection Criteria

The optimum lag length (k) is determined using the Akaike Information Criterion (AIC), Schwarz Criterion (SC), and Hannan-Quinn (HQ) criterion, based on the minimum value of these criteria.

2.2.3. Cointegration Analysis

The Engle & Granger cointegration method is applied to test long-run relationships across six model specifications (Engle & Granger, 1987). The residual series for each model is estimated using the long-term equation by Ordinary Least Squares (OLS). The stationarity of these residuals is then tested using the ADF test (Phillips & Ouliaris, 1990, p. 193).

2.2.4. Error Correction Model (ECM)

For cointegrated series, an ECM is applied to examine short-run dynamics, measure the speed of adjustment toward long-run equilibrium, and analyze the significance of the error correction term. The general ECM equation is (Granger &Weiss, 1983, p 255):

$$\Delta y_t = \alpha_1 \Delta x_t + \alpha_2 e_{t-1} + u_{-t} \ldots\ldots\ldots (7)$$

α_1: the long-term equilibrium relationship between variables X and Y

α_2: The speed and magnitude of adjustment when variables deviate from their long-term equilibrium path

2.2.5. Diagnostic Testing

A rigorous diagnostic testing framework validates the econometric model:

- Jarque-Bera Test: Assesses normality of residuals
- Breusch-Godfrey LM Test: Examines serial correlation
- White and ARCH Tests: Investigate heteroskedasticity
- Stability Tests (CUSUM and CUSUM of Squares)

2.2.6. Causality Tests

Two complementary approaches determine the direction of relationships:

a. Toda-Yamamoto Test: Examines long-run causal relationships by effectively accounting for non-stationary time series

The Toda-Yamamoto causality test relies on a Vector Autoregression (VAR) model of order (k+dmax), where:

k = 1 represents the lag period based on the lowest agreed-upon lag selection criteria

dmax = 1 represents the maximum integration order of the variables.

The methodology involves estimating the model and conducting a Granger causality test using a modified Wald test, which takes the following form (Toda & Yamamoto, 1995, pp. 225-228):

$$Y_t = \alpha_0 + \sum_{i=1}^{(k+\mathrm{dmax})} \alpha_{1i}\, Y_{t-i} + \sum_{i=1}^{(k+\mathrm{dmax})} \alpha_{2i}\, x_{t-i} + \varepsilon_{1t} \quad \ldots\ldots(8)$$

- H_{01}: Variable X does not cause Variable Y

$$X_t = \beta_0 + \sum_{i=1}^{(k+\text{dmax}))} \beta_{1i} X_{t-i} + \sum_{i=1}^{(k+\text{dmax}))} \beta_{2i} Y_{t-i} + \varepsilon_{2t} \quad \text{……..(9)}$$

- H_{02}: Variable Y does not cause Variable X
  - Reject H_0 (causal relationship exists)
  - Accept H_0 (no causal relationship)

b. Granger Causality Test: Establishes directional causal relationships between stationary time series variables.

3. RESULTS :

2.3. Unit Root Test Results

The unit root test results revealed critical insights into the time series data. Most variables were non-stationary at the level, becoming stationary only after first differencing (I(1). This finding is crucial for ensuring a valid econometric analysis.

2.4. Lag Selection

All models utilize a consistent lag order of k= 1, as indicated by the minimum values of AIC, SC, and HQ criteria. This suggests these models most effectively capture the relationship between government spending and economic growth in the Algerian context.

2.5. Long-Run Relationship Results

Four model specifications support Wagner's Law hypothesis (Peacock-Wiseman, Gupta, Goffman, and Pryor), which exhibited statistically significant positive relationships between government expenditure and economic growth. The elasticity coefficients exceeded unity in all significant models ($\beta_2 > 1$), indicating that a 1% increase in GDP corresponds to more than a 1% increase in government spending. The Musgrave and Mann models show statistically insignificant results.

2.6. Cointegration Analysis

A pivotal finding was the Pryor model's unique demonstration of cointegration between real government consumption expenditure and real GDP. Only this specification exhibits a stable long-run relationship.

2.7. Error Correction Model

The Error Correction Model for Pryor's specification reveals a short-run adjustment coefficient of -0.262 (negative and significant -Table 6-),

indicating a negative and moderate correction mechanism toward the long-run equilibrium. The annual adjustment speed of 26.2% implies a relatively slow but consistent movement toward the equilibrium state.

2.8. Diagnostic Tests

The diagnostic tests (Table 7) revealed a robust model with normally distributed residuals and no serial correlation. However, the White test suggested heteroscedasticity, indicating a potential need for advanced modeling techniques. Also, the CUSUM and CUSUM of Squares tests (Figures 2 & 3) confirmed structural stability, with both statistics remaining within the 5% critical bounds throughout the sample period, indicating consistent parameter estimates across different economic regimes.

2.9. Causality Analysis

2.9.1. Granger Causality Results:

The Granger Causality tests (Table 8) showed unidirectional causality from real GDP to real government consumption expenditure in the Pryor specification, with causality running from economic growth to government spending rather than the reverse.

- LNRGDP → LNRGCE: $p = 0.0184 < 0.05$ → Granger causality from GDP to government consumption expenditure (supports Wagner's Law)
- LNRGCE → LNRGDP: $p = 0.2953 > 0.05$ → No evidence that government expenditure Granger-causes GDP

2.9.2. Toda-Yamamoto Causality Results:

The Toda-Yamamoto causality tests across different models reveal predominantly unidirectional causality (Table 9), with economic output (GDP) causing changes in government expenditure.

- Peacock-Wiseman, Gupta, and Goffman models show significant causality from GDP to government expenditure
- No reverse causality (expenditure to GDP) detected in any model
- Results strongly support Wagner's Law

4. DISCUSSION :

4.1. Long-Run Relationships

The long-run estimation results demonstrate that four out of six

models (Peacock-Wiseman, Gupta, Goffman, and Pryor) show significant positive relationships between government expenditure and economic growth. The elasticity coefficients in these models are all greater than 1, indicating that a 1% increase in GDP leads to a more than proportional increase in government spending, which aligns with Wagner's hypothesis.

However, the Musgrave and Mann models show statistically insignificant results, suggesting that the relationship may be sensitive to how the variables are specified and measured. This indicates that while absolute and per capita measures of public expenditure respond strongly to economic growth, the relative size of government expenditure to GDP does not systematically increase with income in Algeria over the sample period.

4.2. Cointegration and Error Correction

The cointegration analysis reveals that only the Pryor model exhibits a true long-run equilibrium relationship between real government consumption expenditure and real GDP. This is evidenced by the stationarity of the residuals at the 5% significance level. The error correction model for the Pryor specification shows a relatively slow adjustment speed of *26.2* % annually toward long-run equilibrium, indicating that short-term deviations from the equilibrium relationship are corrected gradually over time.

4.3. Causality Direction

The causality analysis using both Toda-Yamamoto and Granger approaches provides important insights into the direction of the relationship. The consistent finding of unidirectional causality from economic growth to government spending across different specifications provides strong support for Wagner's Law in the Algerian context. This suggests that economic growth has been a significant driver of government expenditure growth in Algeria during the study period, rather than government spending driving economic growth.

4.4. Model Limitations

The diagnostic tests for the error-correction model indicate that, although the model satisfies the normality and autocorrelation requirements, it exhibits heteroscedasticity. This suggests some limitations in the model's statistical properties and indicates that the results should be interpreted with

appropriate caution.

4.5. Policy Implications

These findings have important implications for understanding the relationship between government spending and economic growth in Algeria. The results generally support Wagner's Law, suggesting that economic growth has been a significant driver of government expenditure growth. This understanding could be valuable for policymakers in formulating fiscal policies and planning government expenditure strategies concerning economic growth trajectories.

5. CONCLUSION

5.1. Main Findings

Our empirical investigation of Wagner's Law in Algeria from 1990 to 2022 provides substantial evidence supporting the validity of Wagner's hypothesis, albeit with some important qualifications. The analysis of six different specifications demonstrates that the relationship between government expenditure and economic growth is robust in four models (Peacock-Wiseman, Gupta, Goffman, and Pryor), with elasticity coefficients consistently exceeding unity.

The Pryor model, in particular, emerges as the most statistically robust specification, exhibiting both cointegration and unidirectional causality from economic growth to government expenditure. This finding is reinforced by both Toda-Yamamoto and Granger causality tests, which consistently show that changes in economic growth precede changes in government spending rather than the reverse.

The error correction mechanism, though showing a relatively slow adjustment speed of *26.2*% annually, confirms the existence of a stable long-run relationship between government consumption expenditure and GDP. The consistent evidence of unidirectional causality from economic growth to government spending suggests that government expenditure in Algeria has been largely driven by economic development rather than serving as a primary driver of economic growth.

5.2. Limitations

Also, the study reveals some limitations, particularly in the Musgrave and Mann specifications, which showed insignificant results, and the presence of heteroscedasticity in the error correction model. These limitations suggest that while Wagner's Law generally holds in the Algerian context, the relationship between government spending and economic growth may be more complex than can be captured by a single theoretical framework.

5.3. Recommendations

Based on our findings, the following recommendations are proposed:

- Economic Diversification: Algeria needs to diversify its economy beyond the hydrocarbon sector to better handle financial shocks and create sustainable economic growth.
- Efficient Resource Allocation: Government spending should be directed more efficiently toward productive sectors to maximize the impact on economic development.
- Policy Effectiveness: The slow adjustment speed (*26.2*%) suggests limited effectiveness of economic policies in influencing government consumption spending in the short run, indicating a need for more responsive fiscal mechanisms.
- Future Research: Future research might benefit from exploring additional specifications or methodological approaches to further understand the complexities of the government expenditure-economic growth nexus.

This understanding is particularly relevant for fiscal policy planning and public expenditure management in the context of Algeria's economic development trajectory.

6. Bibliography List:

Al Alshaikh, H. M. (2002). The relationship between expenditure and economic growth in Wagner's law: International evidence. *King Saud University Journal*, *14*, 136.

Atmania, K., & Ait Yahia, S. (2021). Wagner's Law in Algeria: An econometric analysis during 1967–2018. *Journal of Studies in Economics and Management*, *4*(1), 750-769. Retrieved from https://asjp.cerist.dz/en/article/155679

Babajide, A. A., Okunlola, F. A., Nwuba, E., & Lawal, A. I. (2020). Wagner proposition in Nigeria: An econometric analysis. *Heliyon, 6*(8), -. doi:https://doi.org/10.1016/j.heliyon.2020.e04527

Balaban, S., & Živkov, D. (2021). Validity of Wagner's Law in transition economies: A multivariate approach. *Hacienda Pública Española / Review of Public Economics, 236*(1), 109.

Bazán, I., Álvarez-Quiroz, V. J., & Morales Olivares, Y. (2022). Wagner's Law vs. Keynesian hypothesis: Dynamic impacts. *Sustainability, 14*(16), -. doi:https://doi.org/10.3390/su141610431

Ben Jedou, S., & Ramli, H. (2020). Econometric testing of Wagner's Law in the Algerian economy during the period (1990–2017). *Institute of Economic Sciences Journal*, 891-909.

Erguigue, O. (2023). Public expenditure and economic growth: Empirical validation of Wagner's Law in Morocco. *African Scientific Journal, 3*(17).

Eviews. (12). Output.

EViews. (2024). *EViews*. Récupéré sur Cointegration testing: https://www.eviews.com/help/helpintro.html

Henrekson, M. (1993). Wagner's Law — A spurious relationship? *Public Finance / Finances Publiques, 48*(2), 406–415.

Loizides, J., & Vamvoukas, G. (2005). Government expenditure and economic growth: Evidence from trivariate causality testing. *Journal of Applied Economics, 8*(1), 125-152.

Magazzino, C., Giolli, L., & Mele, M. (2015). Wagner's Law and Peacock and Wiseman's displacement effect in European Union countries: A panel data study. *International Journal of Economics and Financial Issues, 5*(3), 812–819.

Masan, S. S. (2015). *Testing Keynesian versus Wagner hypothesis on the linkage between economic growth and government spending in Oman.*

Musgrave, R. A. (1963). *Essays in fiscal federalism.* Washington, D.C.: Brookings Institution.

Mushtaq, R. (2011). *Augmented Dickey-Fuller test*. Récupéré sur Augmented Dickey-Fuller test: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1911068

Phillips, P. C., & Perron, P. (1988). Testing for a unit root in time series regression. *Biometrika, 75*(2), 335-346.

Toda, H. Y., & Yamamoto, T. (1995). Statistical inference in vector autoregressions with possibly integrated processes. *Journal of Econometrics, 66*(1-2), 225–250.

Verma, S. &. (2010).

Verma, S. A. (2010). Does the Indian Economy Support Wagner's Law? An Econometric Analysis. *Eurasian Journal of Business and Economics*, -.

Wagner, A. (1883). *Finanzwissenschaft* (3rd ed.). C. F. Winter.
Wagner, R. E., & Weber, W. E. (1977). Wagner's Law, fiscal institutions, and the growth of government. *National Tax Journal, 30*(1), 59–68.

7. Appendices

Table N^0(02): Unit Root Test Results

Variable	Level form		First difference		Result
	PP	ADF	PP	ADF	
Ln (RGE)	-2.34 (0.39)	-2.19 (0.47)	- 3.76 * (0.007)	- 3.76 * (0.007)	I(1)
Ln (RGDP)	4.42 (1)	5.96 (1)	- 4.15 * (0.003)	- 4.15 * (0.002)	I(1)
Ln (RGCE)	5.44 (1)	5.93 (1)	-4.67 * (0.000)	- 4.67 * (0.000)	I(1)
Ln (RGE/P)	- 2.35 (0.39)	- 2.18 (0.47)	- 3.28 * (0.001)	- 3.28 * (0.001)	I(1)
Ln (RGDP/P)	1.01 (0.92)	1.41 (0.95)	-3.59 * (0.00)	-3.57 * (0.00)	I(1)
Ln (NGE/NGDP)	- 1.67 *** (0.08)	-1.67*** (0.08)	- 5.33 * (0.00)	-5.31* (0.00)	I(0) / I(1)

Source: (Eviews, 12)

Table N^0(03) : Lag Selection Criteria

Model	Endogenous Variables	HQ	SC	AIC	Lags
Peacock & Wiseman	LNRGE -LNRGDP	**-8.749***	**-8.538***	-8.830	1
Gupta	LNRGE/P- LNRGDP/P	**-8.807***	**-8.595***	-8.888	1
Goffman	LNRGE- LNRGDP/P	**-8.859***	**-8.647***	-8.940	1
Pryor	LNRGCE -LNRGDP	**-8.807***	**-8.596***	**-8.888***	1
Musgrave	LNNGE/NGDP -LNRGDP/P	**-6.936***	**-6.725***	**-7.018***	1
Mann	LNNGE/NGDP -LNRGDP	**-6.941***	**-6.729***	**-7.022***	1

Source: (Eviews, 12)

Table N^0(04): Long-Run Relationship Coefficients

Model	Dependent Variables	Regressors	Coefficient	t-statistic Probability
Peacock & Wiseman	LnRGE	LnRGDP	1.616	**0.000***
		C	-15.84	**0.000***
Gupta	LnRGE/P	LnRGDP/P	2.269	**0.000***
		C	-10.49	**0.000***
Goffman	LnRGE	LnRGDP/P	3.301	**0.000***
		C	-1.6	0.295
Pryor	LnRGCE	LnRGDP	1.166	**0.000***
		C	-5.841	**0.000***
Musgrave	LnNGE/NGDP	LnRGDP/P	0.093	0.524

		C	-0.823	0.495
Mann	LnNGE/NGDP	LnRGDP	0.077	0.269
		C	-2.022	0.256

Source: (Eviews, 12)

Table N⁰(05): Cointegration Test Results (ADF Test for Residuals)

Model	ADF Test Statistic	Result
Critical Values	1% = -3.39, 5% = -2.76, 10% = -2.45	
Peacock & Wiseman	-2.071	No cointegration
Gupta	-1.430	No cointegration
Goffman	-0.939	No cointegration
Pryor	**-3.165****	**Cointegration exists**
Musgrave	-2.054	No cointegration
Mann	-2.107	No cointegration

Source: (Eviews, 12)

Table N⁰(06): Error Correction Model (ECM) Results for Pryor Model

Model	Variable	Coefficient	Probability
Pryor	Constant	0.031	**0.000*****
	ΔLnRGDP	0.152	0.521
	ECM(-1)	-0.262	**0.012****

Source: (Eviews, 12)

Table N⁰(07): Diagnostic Test Results for the ECM (Pryor Model)

Test	Statistic	Probability	Decision
Jarque-Bera	0.031	0.984	Normality accepted
LM Test	1.727	0.199	No serial correlation
	Obs*R^2 = 1.859	0.173	The model is dynamically well specified
ARCH Test	0.039	0.845	No ARCH effects heteroskedasticity
	Obs*R^2 = 0.042	0.838	No volatility clustering
White Test	4.316	0.005	Heteroskedasticity detected

Source : (Eviews, 12)

Table N⁰(08): Granger Causality Test Results - Pryor Model

Null Hypothesis (H_0)	Chi-Square	Probability	Decision	Direction
LnRGDP does not Granger cause LnRGCE	**5.555**	**0.0184***	**Reject H_0**	**GDP → Government Expenditure**
LnRGCE does not Granger cause LnRGDP	1.095	0.2953	Accept H_0	No causality

Source: (Eviews, 12)

Table N⁰(09): Toda-Yamamoto Causality Test Results

Model	Null hypothesis (H0)	Prob	Decision
Peacock & Wiseman	LnRGE does not cause LnRGDP	0.1707	No causality
	LnRGDP does not cause LnRGE	0.0084	**LNRGDP → LNRGE**
Gupta	Ln(RGE/P) does not cause Ln(RGDP/P)	0.1712	No causality
	Ln(RGDP/P) does not cause Ln(RGE/P)	0.0016	**LNRGDP/P → LNRGE/P**
Goffman	LnRGE does not cause Ln(RGDP/P)	0.1920	No causality
	Ln(RGDP/P) does not cause LnRGE	0.0150	**LNRGDP/P → LNRGE**
Pryor	LnRGCE does not cause LnRGDP	0.7534	No causality
	LnRGDP does not cause LnRGCE	0.1243	No causality
Musgrave	Ln(NGE/NGDP) does not cause LnRGDP/P	0.3908	No causality
	LnRGDP/P does not cause Ln(NGE/NGDP)	0.2373	No causality
Mann	Ln(NGE/NGDP) does not cause LnRGDP	0.3935	No causality
	LnRGDP does not cause Ln(NGE/NGDP)	0.4048	No causality

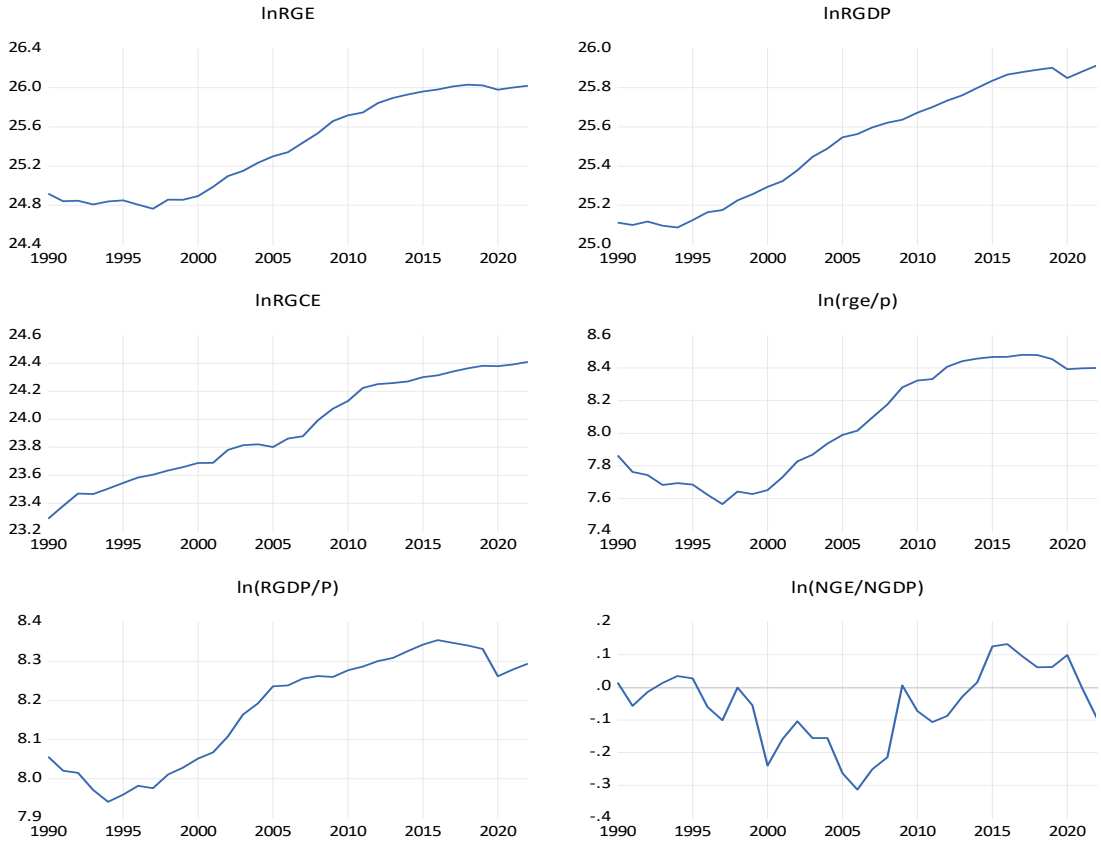
Source: (Eviews, 12)

Table N⁰(10): Wagner's Law Validity by Model:

Model	Long-Run Relationship	Cointegration	Causality	Support
Peacock & Wiseman	✓ Significant (β=1.616)	✗	✓ GDP→GE	**Partial**
Gupta	✓ Significant (β=2.269)	✗	✓ GDP→GE	**Partial**
Goffman	✓ Significant (β=3.301)	✗	✓ GDP→GE	**Partial**
Pryor	**✓ Significant (β=1.166)**	**✓ Yes**	**✓ GDP→GE**	**✓ Full Support**
Musgrave	✗ Not significant	✗	✗	**Not Supported**
Mann	✗ Not significant	✗	✗	**Not Supported**

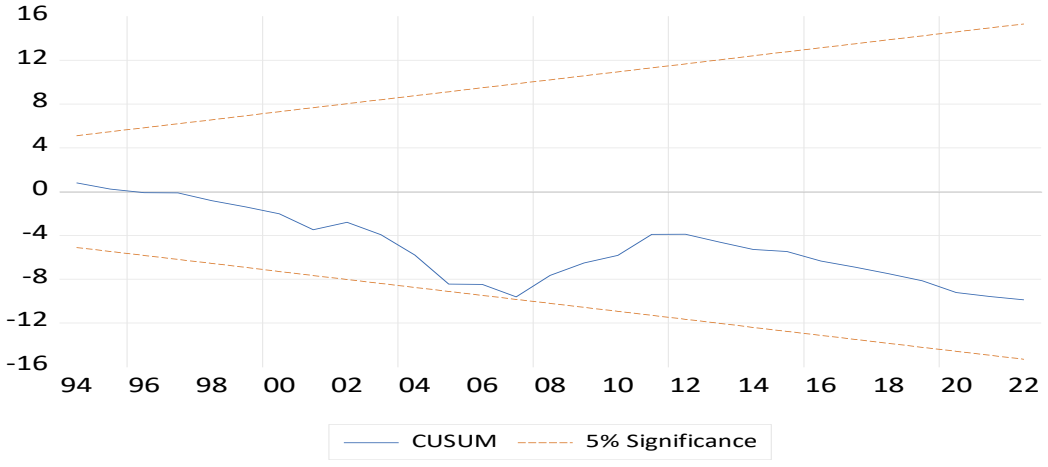
Source: Authors

Fig N⁰(01): Algeria's Economic Indicators Trend (1990-2022)



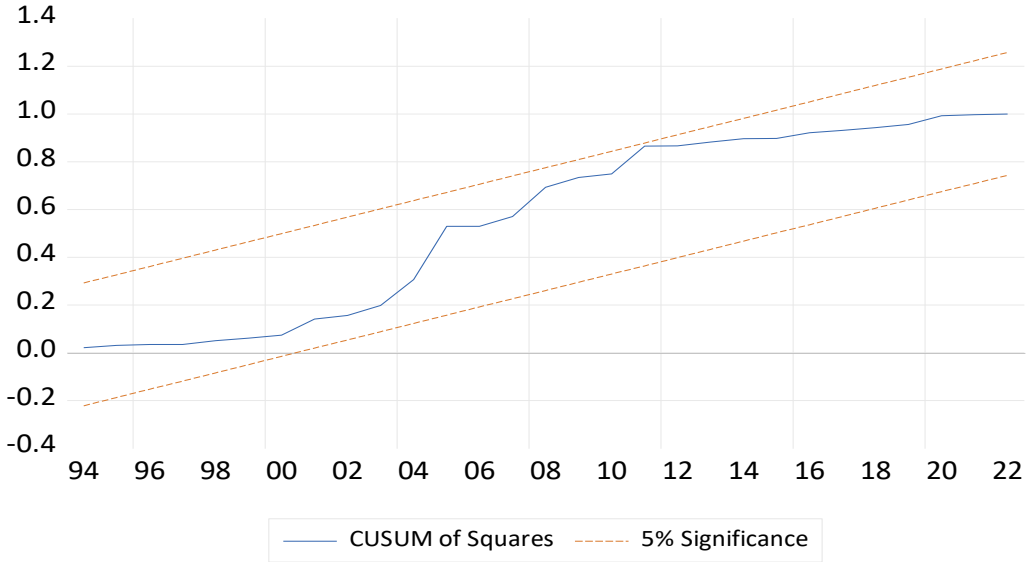
The source: (Eviews, 12)

Fig N^{0}(02): CUSUM (Pryor Model)



The source: (Eviews, 12)

Fig N^{0}(03): CUSUM of Squares (Pryor Model)



The source: (Eviews, 12)