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Keynes Versus Wagner: Public Expenditure and National Income Case Study of Tunisia

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Abstract

This study aims to investigate the relationship between public expenditure and economic growth in Tunisia spanning from 1965 to 2019. Primarily, the validity of Wagner's law and Keynes' hypothesis was tested through time series analysis of public expenditure and national income measures. The key findings suggest non-stationarity in the time series data alongside the existence of a cointegration relationship. Additionally, Granger causality testing within the error-correction model revealed bidirectional causality from national income to government expenditure, thereby confirming Keynes' hypothesis for Tunisia during the study period. Furthermore, nonlinear analysis of the Wagner version, employing the threshold model, lends support to this hypothesis, highlighting the presence of two thresholds over the study duration. These findings shed light on the relationship between public spending and economic growth in Tunisia. They offer important insights that can be useful for both policymakers and researchers alike.

Keywords: Economic Growth, Public Expenditure, Wagner's Law, Granger causality tests, Cointegration test, Threshold Regression Model

1. Introduction

Starting in 1980, researchers began to develop growth theories to verify and understand the links between public expenditure and national income. Income distribution and redistribution help increase consumer demand as well as social equity; public spending plays an essential role in infrastructure investment and enables the provision of numerous services more efficiently. Therefore, the relationship between public spending and national income has raised interest among economists both theoretically and empirically. Numerous research studies attended and focused on determining the causality between the two variables, whether

it is Wagner's law and/or Keynes' hypothesis that takes effect, along with other studies related to the linearity between these two variables.

The broader view of Wagner's law claims that the growth of the public branch is determined by the level of development attained by society. Bird (1971) claims that as countries become increasingly industrialized and have higher gross earnings per capita, the amount of spending directed to the public sector grows as well (Chletsos and Kollias, 1997). This expansion indicates the increasing requirement for government intervention in the economy, especially in the supply of public goods and services. In contrast, based on the hypothesis of Kenneth, the increase in spending net of government which however is not affected by the economy is one of the factors for the growth in the national output. From this Keynesian perspective, an economy that has low demand requires well-calculated and adequate public spending in order to increase the level of economic growth (Ansari et al., 1997). Research in this area has revealed contrasting causal relationships, with important implications for policymaking. In the case of Wagner's theory, public expenditure comes as a result of economic activity, an outcome, while in the case of Keynes, it is an important instrument that enhances economic growth. Both of these theories, however, are soundly reasoned and one cannot simply reject them.

Nevertheless, despite the large number of empirical investigations, no common framework of results has been attained. Instead, mixed results, different interpretations, and lack of consensus have characterized studies, further muddling the debate. Most of the earlier studies focused on the relationship between total public spending and economic growth.

Building on previous research efforts, this paper aims to provide a comprehensive examination of the relationship between public expenditure and national income in Tunisia by testing the validity of both Wagner's Law and Keynes' hypothesis. Specifically, the study seeks to achieve the following research objectives:

1. To empirically assess whether Wagner's Law, which suggests that public expenditure increases as national income grows, holds true in the Tunisian context over the period from 1965 to 2019.
2. To evaluate the applicability of Keynes' hypothesis, which posits that increased public expenditure can drive economic growth, within Tunisia's economic framework.
3. To investigate potential non-linear relationships between public expenditure and national income, identifying any threshold effects or structural changes that may influence the dynamics of the relationship.

To address these objectives, the study formulates the following hypotheses:

- **Hypothesis 1:** There is a long-term positive relationship between national income and public expenditure in Tunisia, supporting Wagner's Law.
- **Hypothesis 2:** Public expenditure has a significant short-term and long-term impact on economic growth in Tunisia, in line with Keynesian theory.
- **Hypothesis 3:** The relationship between public expenditure and national income in Tunisia exhibits non-linear characteristics, suggesting the presence of threshold effects or structural breaks.

The study employs rigorous time series econometric methods to achieve these objectives.

Unit root tests will be conducted to determine the stationarity properties of the variables, followed by cointegration analysis to establish any long-term equilibrium relationships. Error correction modeling (ECM) will be used to capture short-term dynamics, while Granger causality tests will be applied to identify the direction of causality between public

expenditure and national income. These methods provide a robust framework for analyzing the complex interplay between public spending and economic growth in Tunisia.

This research contributions to the literature differs for several reasons from previous studies conducted for the Tunisian case. Firstly, a longer dataset is used. Secondly, new and more advanced econometric techniques than those previously used in this field are applied to obtain richer and more plausible results. Thirdly, this research considers both propositions, Wagner's law and Keynes' hypothesis, in the same investigation. Finally, estimation using the threshold model method to verify non-linearity will be conducted.

The tackling of this problematic will be conducted through several stages, the first phase will present literature reviews previously conducted on this subject, then show the study purpose through empirical evidence that led us to dive more into the problematic. The second phase will address the empirical analysis of the relationship between public spending and economic growth including the methodology, model, and the data. Followed by empirical tests diagnostic and estimation results analysis. Finally, we will conduct an economic discussion of the obtained results followed by the conclusion.

2. Literature Review

Wagner introduced the idea of the "law of the increasing extension of state activity," which suggests that as economies develop, government functions tend to expand over time. His theory highlights how the role of government becomes increasingly important as society progresses. He identified three main factors driving this growth in public functions. First, as the responsibilities of government grow, there's a need for more public spending on administrative duties and economic regulation. Second, in modern industrial societies, there's a rising demand for social progress, which means that governments need to pay more attention to societal welfare in their management practices. Lastly, public spending often increases at a faster rate than national income, indicating that the growth of public expenditure is more elastic than one, leading to a relative expansion of the public sector.

The relationship between national income and public spending has been a key area of interest in economic research for quite some time. Researchers have looked at how public spending can impact national income from two main angles. First, there's the perspective rooted in Wagner's law, which suggests that as national income rises, public expenditure tends to increase as well. This happens mainly because people demand more public services, similar to how they might seek out private goods and services. On the other hand, we have the Keynesian viewpoint, which sees public spending as a tool that can actively stimulate economic growth. According to this theory, when the government increases its spending, it can lead to a boost in national income. In this context, public expenditure plays a crucial role in driving economic growth. So, whether you're looking at it from the angle of rising income leading to more spending or the government using its budget to spur growth, it's clear that the interplay between national income and public expenditure is significant.

Many developing countries recognize the importance of their public sectors in driving growth and development. This idea is often supported by the existence of market failures. In these situations, governments play a crucial role in mediating conflicts between private interests and the broader social good, tackling foreign influences, and encouraging investments that benefit society as a whole. Consequently, a robust public sector, marked by significant public spending, is often seen as a key contributor to the growth of national income.

The literature yields two different results regarding the relationship between public spending and growth. However, some researchers find a positive relationship while others find a

negative one, highlighting a non-linear relationship linking the two. In fact, for Wagner's law, the increase in national income does not always have the same effect on public spending. Sometimes, the increase in national income may originate from other complementary or substitutable sources. As a result of the preceding debate, there is extensive empirical literature aimed at analyzing the relationship between public spending and economic growth.

Several studies support the Keynesian perspective by demonstrating a causal relationship from public expenditure to GDP growth. In Greece, a multivariate analysis revealed causality from government expenses to GDP, supporting the Keynesian approach in both the long and short run (Efthalitsidou et al. 2021). Similarly, a study in Kosovo found a unidirectional influence of government expenditures on GDP, bolstering the Keynesian perspective (Pula and Elshani, 2018). In Nigeria, research indicated a short-run causal relationship running from public expenditure to national income, validating Keynesian theory (Akpan, 2011). Furthermore, research on the Gulf Cooperation Council (GCC) countries, while ultimately supporting Wagner's Law, acknowledged the potential for public expenditure to stimulate growth in certain contexts (Al-Faris, 2002). A study in Tanzania found that recurrent expenditure and development expenditure from foreign sources promoted economic growth, aligning with the Keynesian hypothesis (Paul and Furahisha, 2017).

On the other hand, Numerous studies have found evidence supporting Wagner's Law. Ansari et al. (1977) analyzed the effects of public spending on gross national product for three African countries using time series data, the research results of which show a mixed picture depending on the calculation methods used. Among the three series, only that of Ghana showed that public spending was influenced by national income, reflecting the validation of Wagner's law. This fact demonstrates the predominant role of Global Expenditure “GE” as an endogenous factor in economic development. Similarly, Akpan's research on Nigeria found strong support for Wagner's long-run postulate, showing a causal relationship from national income to public expenditure (Akpan, 2011). Demez's study of eleven EU member transition economies confirmed that economic growth preceded increases in public expenditure, validating Wagner's Law (Demez, 2021). Al-Faris's examination of GCC countries also supported Wagner's hypothesis, showing that national income predicted government expenditure growth (Al-Faris, 2002). In addition, Sideris's study of 19th-century Greece found causality running from national income to government expenditure, aligning with Wagner's hypothesis (Sideris, 2007). A study in Nigeria also supported Wagner's Law, showing a significant relationship between GDP and government expenditure, with a bidirectional causal relationship (Nurudeen et al.,2021).

Shih-Ying et al (2010) in their study found that Wagner's law applies much more consistently in developed countries than in those that are still developing. They noted that while public spending can have a positive impact on economic growth—especially when it’s directed toward building public infrastructure—it can also have negative effects if the government invests in projects that hinder growth. These differing outcomes might stem from variations in how models are specified, the econometric techniques employed, or the ways government spending is measured. Alm and Embaye's (2010) research, which looked at the link between public spending and real income per capita in South Africa from 1960 to 2007, highlighted that public spending is shaped not just by income levels and the costs of maintaining government size, but also by what’s known as fiscal illusion. This phenomenon arises from the disconnect between revenue and expenditure, alongside external factors like fluctuations in oil prices that can create economic shocks. Rehman et al. (2010) studied the direction of causality between national income and public spending as well as various aspects of public spending in Pakistan for the period 1971-2006. The results of their study also support the validity of Wagner's law in Pakistan.

Research on Sub-Saharan African countries found a long-run relationship between public expenditure and income proxies, with bidirectional causality supporting both Keynesian and Wagnerian hypotheses (Ahmed and Hanifa, 2018). Similarly, a study in India found Wagner's Law to be partially valid, with economic growth significantly influencing public expenditure growth (Kaur and Afifa, 2017). Furthermore, research in Pakistan supported Wagner's Law, demonstrating a unidirectional causality from economic growth to public expenditure (Cheema and Iqbal, 2017). A study on Indonesia revealed unidirectional causality from GDP and price to government expenditure, further supporting Wagner's Law (Inchauspe et al. 2020). However, studies in Nigeria (Babatunde, 2011) and Oman (Masan, 2015) did not find support for Wagner's Law.

An analysis of 23 high-income countries conducted between 1970 and 2006 by two central bank economists confirmed an "absolute correlation between public spending and GDP per capita." A study by IMF staff on 51 developing countries found a consistent link for all countries, confirming "a long-term relationship between public spending and productivity, in line with Wagner's law." Another analysis of India between 1950 and 2008 also confirms "the validity of Wagner's law in India, indicating the existence of a sustainable relationship between economic growth and increased public spending".

More remarkably, the literature identifies two forms of relationships (linear and non-linear) between national income and public spending. Indeed, Sheeley (1993), Armey (1995), Tanzi and Zee (1997), Vedder and Gallaway (1998), Giavazzi, Japelli, and Pegano (2000) supported a linear relationship while others suggested the existence of a non-linear-or-even-quadratic-relationship between the volume of government spending and economic growth.

One of the reasons for conducting this research is that we realized there are very few studies that have devoted an analysis of the impact of public spending on economic growth in Tunisia. Moreover, the causality test conducted via a linear relationship generates mixed results, suggesting the existence of a non-linear relationship. Thus, we are starting by proving there is a strong correlation between the variables in the first version of the law (very significant with an order of 0.9984). Indeed, the visual correlation between the variables increases in the other two versions as shown in the graphs of Figure 1.

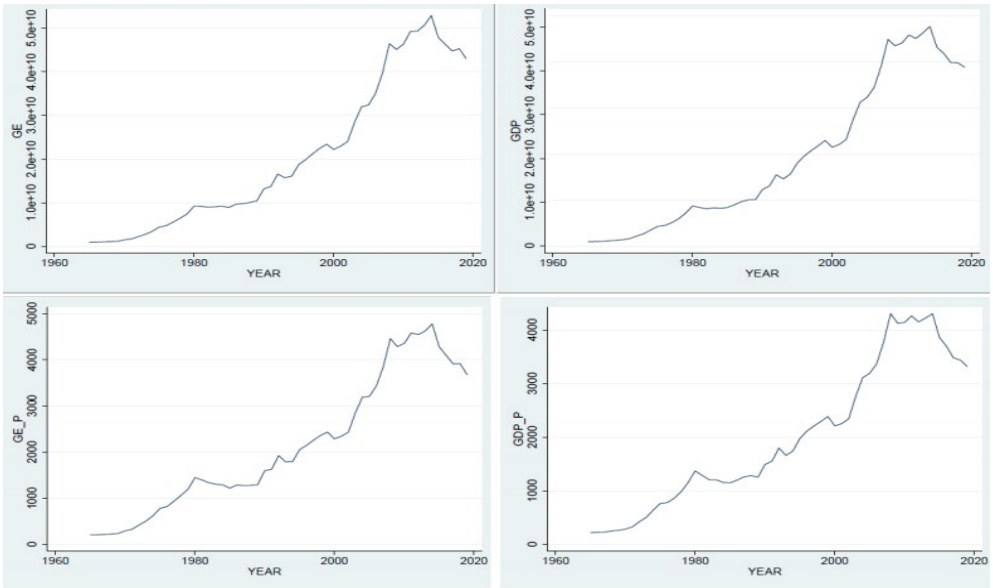

Figure 1: Versions of Wagner's law
Source: Eviews 7 output

The increase in Global Expenditure "GE" could be due to the increase in current income due to recruitment positions and/or the improvement of infrastructure (to encourage investment and to introduce the designed structural adjustment program). This aims to move the country towards a developing nation.

In order to confirm the degree of the correlation between variables more precisely to quantify the correlations sketched in Figure 1, Table 1 gives the correlations 2 by 2 for all the variables used in this work. Thus, Pairwise correlations are sufficiently strong among all the variables, as depicted in Table 1. Therefore, this paper further investigates these correlations to test Wagner's law and/or the Keynesian hypothesis, estimating different specifications of the relationship between public expenditure and national income.

Table 1: Variable correlation matrix

Variables	***GE***	***GDP***	***GE/P***	***GDP/P***
GE	*1.0000*			
GDP	*0.9984****	*1.0000*		
GE/P	*0.9945****	*0.9959****	*1.0000*	
GDP/P	*0.9894****	*0.9944****	*0.9979****	*1.0000*
Source: Eviews 7 output				

3. Materials and Methods and Data

To test the validity of Keynes' hypothesis and Wagner's law during the analysis period, three empirical models are used.

Model-1 is the one used in numerous studies conducted by Peacock and Wiseman (1967), Musgrave (1969), and Goffman and Mahar (1971). It is the simplest form among all versions of Wagner's law:

$$GE = f(GDP) = \alpha_0 + \alpha_1 GDP_t + \varepsilon_t \quad (1)$$

- Where GE denotes total public expenditure (current + capital), GDP is the real gross domestic product, and "ε_t"is a random term, with the coefficient $\alpha_1>0$.

Model-2 propounded by Goffman (1968), assumes that with economic development and growth of a country, the public sector activities increase. Also, if this increase is measured in terms of expenditure, then it is supposed to be higher than the per capita output growth rate:

$$GE = f\left(\frac{GDP}{P}\right) = \beta_0 + \beta_1\left(\frac{GDP}{P}\right)_t + \varepsilon_t \quad (2)$$

- Where GDP/P denotes gross domestic product per capita, P is the population size and $\beta_1>0$.

Model-3 *is* the one used by Gupta (1967) and Michas (1975) to determine whether the elasticity of public spending per capita relative to gross domestic product (GDP) per capita exceeds unity or not:

$$\frac{GE}{P} = f\left(\frac{GDP}{P}\right) = \gamma_0 + \gamma_1\left(\frac{GDP}{P}\right)_t + \varepsilon_t \quad (3)$$

- Where GE/P denotes public spending per capita and $\gamma_1>0$.

The main objective of this analysis is to determine whether Wagner's law and/or Keynes' hypothesis applies to the Tunisian economy. More specifically, this is achieved by checking for whether GE and GDP are cointegrated, that is, they have a long-run equilibrium relationship, and in what direction the causality runs, especially whether GDP Granger causes

GE or vice versa. Verification of these two conditions will prove Wagner's law and Keynes' hypothesis.

We looked into the relationships between various economic variables in Tunisia using annual time series data that spans from 1965 to 2019. This data, which we obtained from the World Bank's World Development Indicators (WDI), has been standardized to ensure that all variables are measured in the same unit.

4. Diagnostic Tests, Estimation Results

In this article, we use a four-step approach to our analysis. First, we conduct unit root tests, followed by cointegration analysis. Next, we apply vector autoregressive modeling, and finally, we perform Granger causality tests. We also estimate a threshold model to explore the non-linear relationship between public spending and national income.

4.1 Unit Root Tests

The first step in analyzing time series data is to check for unit roots, which helps us figure out if the variables we're looking at are stationary or non-stationary. If the variables are stationary, we can use standard econometric methods to explore their equilibrium relationships. On the other hand, if they turn out to be non-stationary, we need to conduct cointegration tests. For these tests to work properly, the variables should be stationary when we look at their first differences. When it comes to unit root tests, the most commonly used ones are the augmented Dickey-Fuller (ADF) test and the Phillips-Perron (PP) test. Using both of these tests can give us a more reliable picture of whether unit roots are present in our data. You can find a summary of the results from these tests in Table 2.

Table 2: Results of ADF and PPs unit root tests

Variables	***ADF test statistic value***	***5% Mackinon critical value***	***Order of integration***	***Phillips Perron***
GDP	*-5.054835*	*-2.917650*	*I(1) with constant*	*-5.086948*
GDP/P	*-5.070195*	*-2.917650*	*I(1) none*	*-5.049912*
GE	*-5.418531*	*-2.917650*	*I(1) with constant*	*-5.841380*
GE/P	*-5.471536*	*-2.917650*	*I(1) none*	*-5.535485*
Source: Eviews 7 output				

4.2 Cointegration Analysis

After verifying that all the variables analyzed are integrated of order one, I(1), the cointegration test analysis can be applied. Cointegration implies similar behavior over time, and it cannot diverge persistently. The existence of this combination suggests that there is a long-term equilibrium relationship between the variables considered. If the result of this test is favorable, then it is possible to analyze their short-term dynamics. The theory of cointegration introduced by Granger (1986), and subsequently developed by numerous authors, can be considered an approach to highlight stable linear relationships between non-stationary time series data. The test for the existence of cointegration relationships is approached using the multivariate Johansen (1988) approach, with the estimation of an error correction model (ECM).

Due to its nature, this test provides, in the first stage, the number of cointegration relationships, but not which are the cointegrated variables. Among others, the advantages of the method include the fact that it simultaneously tests the integration order of the variables and the existence of a cointegration relationship between them. It estimates all the cointegration vectors without assuming any particular vector. It is insensitive to the problem

of endogeneity of the variables that form the cointegration relationship (Suriñach et al., 1995). Results for this specification are reported in Table 3.

The latter relationship suggests, economically, that even though two variables drift apart over time and do not settle down around a constant mean, economic forces prevent these series from drifting apart indefinitely as suggested by Kolluri et al. (2000).

Table 3: Cointegration test results

Model	***Maximum Eigen value***	***Trace statistics***	***5% Critical value***	***Hypothesised Number***
GE and GDP	*0.008121*	*0.415867*	*3.841466*	*r≤1*
GE and GDP/P	*0.043015*	*2.330293*	*3.841466*	*r ≤1*
GE/P and GDP	*0.013418*	*0.661914*	*3.841466*	*r≤1*
GE/P and GDP/P	*0.046778*	*2.539115*	*3.841466*	*r≤1*
Source: Eviews 7 output				

4.3 Vector Autoregressive Modeling, and Granger Causality Tests

In the second stage of the Johansen procedure (1988), we focus on estimating an Error Correction Model (ECM). This step helps us understand the short-term dynamics between different variables. The beauty of this method is that it allows us to estimate both the cointegration relationship and the ECM at the same time. Essentially, the ECM combines insights about long-term equilibrium with a mechanism that shows how quickly variables adjust to reach that equilibrium. It serves as a systematic approach to correcting any imbalances that might arise.

Once we've estimated the ECM, we can dive into examining the causal relationship between public spending and national income across the three different versions of our study. To do this, we use the Granger causality test within the ECM framework. This test helps us determine if the past values of one variable significantly affect the current values of another variable, as outlined by Enders (2004). Engle and Granger point out that if two variables are integrated of order I(1) and are cointegrated, there should be some form of causality—either unidirectional or bidirectional—between the I(0) variables (Biswal et al., 1999). You can find the results of these tests presented in Table 4.

Table 4: Granger causality and ECM (based on error correction term)

Variables	***Number of Obs***	***Lag length***	***ECM (coefficient)***	***Proba***	***Keynes Hypothesis***	***Wagner Law***
GDP vers GE	*55*	*3*	*-1.953111*	*0.0284*		*Yes*
GE vers GDP	*55*	*3*	*-1.477297*	*0.1094*	*No*	
GDP/P vers GE	*55*	*1*	*-0.211852*	*0.0207*		*yes*
GE vers GDP/P	*55*	*1*	*-1.05(-8)*	*0.0205*	*yes*	*-*
GDP/P vers GE/P	*55*	*1*	*-1.034204*	*0.4220*	*-*	*No*
GE/P vers GDP/P	*55*	*1*	*-0.785527*	*0.2670*	*No*	*-*
Source: Eviews 7 Output						

4.4 The Threshold Models

Threshold models find applications across various fields, especially in time series analysis. The basic concept behind these models is that a process can behave differently once a variable crosses a specific threshold. Essentially, threshold models are a type of regime-switching model. They encompass a variety of non-standard regression approaches that hinge on change points or thresholds. What's great about these models is that they offer a straightforward yet elegant way to capture certain nonlinear relationships between outcomes and predictors, making them both interpretable and effective.

The threshold model represents structural breaks in the relationship between variables. This type of model is renowned in nonlinear time series that cannot be adequately described and analyzed using linear techniques. Model features include the asymmetric behavior of the series over the economic cycle and regime change. Threshold regression models have developed rapidly over the three decades following the pioneering work of Tong and Lim (1980), Tong (1983), and widely discussed with Tong (1990). This model can capture many economic phenomena. Consequently, there is a significant and growing literature on regime-switching models in reduced form of macroeconomic time series, particularly on production and unemployment.

The empirical model chosen according to Wagner's law is as follows:

$$Log\,(GE) = \begin{cases} \alpha_0 + \alpha_1 \log(GDP), \log(GDP) < \Lambda \ (1) \\ \beta_0 + \beta_1 \log(GDP), \Lambda \leq \log(GDP) < \sigma \ (2) \\ \eta_0 + \eta_1 \log(GDP), \sigma \leq \log(GDP) < \tau \ (3) \\ \delta_0 + \delta_1 \log(GDP), \log(GDP) \geq \tau \ (4) \end{cases}$$

Table 5: Outputs of threshold model Via Stata output

VARIABLES	***(1) Log (GE)***	***(2) Log(GE)***	***(3) Log (GE)***	***(4) Log (GE)***
Log(GDP)	*1.069****	*1.065 ****	*0.980****	*0.942****
	(0.00766)	*(0.0463)*	*(0.0471)*	*(0.122)*
Constant	*-1.494 ****	*-1.475*	*0.495*	*1.489*
	(0.169)	*(1.077)*	*(1.127)*	*(2.986)*
Observations	*55*	*55*	*55*	*55*
Threshold 1	*-*	*22.9225*	*-*	*-*
threshold 2	*-*	*-*	*23.6154*	*-*
Treshold3	*-*	*-*	*-*	*24.2607*
Threshold viable	*Log(GDP)*	*Log(GDP)*	*Log(GDP)*	*Log(GDP)*
Numbers of threshold	*3*	*3*	*3*	*3*
*S Standard errors in parentheses: ***<0.01, ** p<0.05, * P<0.1 Source: Eviews 7 output*				

To determine the parameters of this system, the threshold model is applied after logarithmic transformation for the two variables GE and GDP. The obtained results are given in Table 5 for 55 observations.

Based on the outputs of the 5th table above and the Figure 2 related to the threshold model, The estimation of regression slopes reveals the impact of national income on public spending in the three regimes considered:

- When the value of Log (GDP) is less than 22.9225, the slope coefficient rises to 1.069. This positive value implies a positive relationship between national income and public spending.
- When the value of Log (GDP) is between 22.9225 and 23.6154, the slope coefficient is around 1.065. This positive value also indicates a positive relationship but with a lower intensity than the previous one.
- When the value of Log (GDP) is between 23.6154 and 24.2607, the slope coefficient is around 0.980. This positive value also indicates a positive relationship but with a lower intensity than the previous one.
- When the value of Log (GDP) is greater than 24.2607, the slope value becomes 0.942, but it is lower than the previous 3 values.

In conclusion, it is possible to suggest that the optimal threshold of national income favoring public spending in Tunisia is 22.9225.

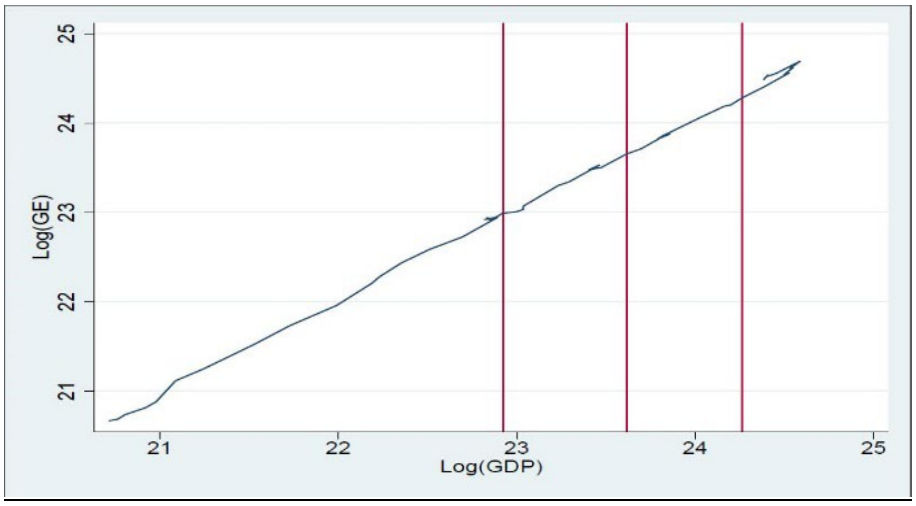

Figure 2: Sketch of the output of the threshold model
Source: Eviews 7 output

5. Discussion

The scientific approach adopted to address the two objectives previously set results and interpretations is detailed as follows:

The first objective depends on the unit root test for the variables retained in the three model versions, the results of which are summarized in Table 2. To decide on this test, the P-value is used such that the null hypothesis assumes non-stationarity. Indeed, if the P-value < 0.05, the alternative hypothesis is retained, indicating that the series under study is stationary. The results of the stationarity test thus conducted suggest the possibility of a long-term relationship between the variables studied. Then, the cointegration test, which verifies this long-term relationship between the study variables, provides the statistics in Table 3. These results were analyzed based on trace statistics and the maximum eigenvalue to determine the number of cointegrations. The favorable results of the unit root test and the cointegration test allow for estimating an ECM and testing Granger causality, which is the first objective. The results of these tests are presented in Table 4. This same table indicates bidirectional causality verified for the second version and unidirectional causality in the first version, supporting Wagner's proposition. This latter causality confirms the results of the studies by Oxley (1994), Wing Yuk (2005), Aregbeyen (2008), Chimobi (2009), and Tang (2010).

These results show that the growth of aggregated GE is explained by Wagner's law by influencing national income. Furthermore, the two-way causality relationship in this study confirms those of the works by Cheng and Wei (1997), Ouattara (2007), and Ngakosso (2016). The verification of Wagner's law is consistent with several previous studies, including those by Yousefi and Abizadeh (1992) for the United States, in a study of 52 countries grouped by their GDP per capita over the period (1952-1962), and that of Ansari et al. (1997) for African countries (Ghana, Kenya, and South Africa). The empirical results of research subsequent to these studies also confirm the validity of Wagner's law in developed countries, including those of Gyles (1991) for the United Kingdom and Nomura (1995) for Japan.

For this study, Keynes' hypothesis is verified. Public spending is considered a source of market imbalance by either hindering or promoting economic development according to the adopted policy. Consequently, public spending increases overall demand, leading to an increase in national production. In the Keynesian model, an increase in public spending leads to higher economic growth. Therefore, the results obtained and reported in this study may be considered better than the results of most previous studies due to the length of the data series used and the use of more refined and advanced statistical tools.

For the second objective, the data in Table 5 indicate that the relationship between public spending and national income is non-linear. These results also reveal that national income influences public spending in different ways, particularly depending on the level of national income achieved by the country in question. Finally, the optimal threshold found, which can most improve public spending, is approximately 22.9225. It induces a marginal effect of 1.069 points, suggesting that a 1% increase in national income improves public spending in Tunisia by 1.069%, all else being equal. Figure 2 illustrates this analysis.

At the end of this study, the results of the non-linearity test align with the conclusions proclaimed by the neo-Keynesian current, which states that in the short term and in situations of weak economic activity, public spending as development or management expenses, regardless of their destination, contribute to reviving economic activity, Barro (1990). Similarly, this conclusion is in line with the neoclassical current stating that development spending on infrastructure contributes to promoting development and the efficiency of private investments, which also helps revive economic activity, Barro and Sala-i-Martin (1995).

6. Policy Implication and Recommendations

Based on the study findings and previous research, several important policy implications and recommendations can be adopted for the Tunisian government. First, the evidence supporting the Keynesian perspective (Sudarsono, 2010), (In-hee, 2021), (Yang and St. John, 2023), (Djokoto et al., 2022) suggests that strategic public investments can drive economic growth, but their effectiveness depends on their composition (Onuoha and Moses Oyeyemi, 2019). Malaysia's experience demonstrates that investments in education and infrastructure not only enhance employment generation but also foster long-term economic development and social equity (Zain, 2014), (Tembe and Xu, 2012), (Jimenez, 1994). Similarly, South Korea's targeted regional development policies highlight the need for balanced economic growth to prevent excessive urban concentration and inequality (In-hee, 2021). Tunisia should adopt a similar strategy by prioritizing high-return investments in infrastructure and human capital, particularly in underserved regions, to stimulate broad-based economic development (Uddin et al, 2020).

Second, the findings highlighting significant socio-demographic inequalities (Ramadan et al., 2017) underscore the need for targeted interventions to ensure that the benefits of economic growth are shared equitably across different segments of the population. (Das et al., 2022), (In-hee, 2021), (Djokoto et al., 2022). Malaysia’s targeted interventions in rural development, education, and income redistribution significantly reduced poverty and improved social cohesion (Zain, 2014). Likewise, research on urban infrastructure (Das et al., 2022) emphasizes the importance of using data-driven approaches, such as well-being surveys and spatial analysis, to design policies that effectively address disparities in access to education, healthcare, and economic opportunities. The findings from agricultural foreign direct investment studies further highlight the importance of human capital development and infrastructural improvements in reducing inequalities (Djokoto et al., 2022). Tunisia should

leverage similar methodologies to ensure that growth reaches marginalized communities, thereby reducing socio-economic imbalances (Ayisi et al., 2016).

Third, tackling corruption in public spending, particularly in critical sectors such as defense and healthcare (Onuoha and Moses Oyeyemi, 2019), (Wei, 2000), (Tembe and Xu, 2012), (Babu, 2006), is essential. Malaysia's success in maintaining growth and equity was bolstered by trade-friendly policies and robust governance mechanisms (Zain, 2014). Additionally, the Special Governance Zones (SGZs) model proposed by Wei (2000) provides an innovative way to test anti-corruption measures in limited geographic areas before scaling them nationwide. The UN Convention Against Corruption (Babu, 2006) outlines legal frameworks that Tunisia can adopt to strengthen its anti-corruption measures. Moreover, findings from Nigerian anti-corruption efforts suggest that incorporating cultural and social factors enhances reform effectiveness (Omadjohwoefe, 2014). Tunisia should strengthen its institutional frameworks by improving auditing processes, enhancing transparency in government procurement, and implementing whistleblower protections to ensure that public funds are allocated efficiently and effectively (George, 2000).

Finally, the complex interplay between government spending and economic growth necessitates a data-driven and adaptive policy approach (Das et al., 2022), (Tembe and Xu, 2012), (Babu, 2006). Studies on foreign direct investment and income inequality (Nguyen, 2021) highlight the importance of good governance and education in fostering inclusive economic development. Moreover, manufacturing sector research (Haraguchi et al., 2019) underscores the role of human capital and institutions in sustaining long-term industrial growth. The analysis of factors affecting successful educational policy implementation (Ohene, 2023) stresses the need for a holistic approach considering governmental, economic, social, and technological factors. Additionally, institutions play a critical role in mediating the relationship between human capital and economic growth (Uddin et al, 2020).

The policy implications and recommendations outlined above, informed by the evidence from successful economies, provide a framework for Tunisia to achieve sustainable economic growth and social equity. The findings consistently highlight the importance of strategic public investments in education and infrastructure, the need to address socio-demographic inequalities through targeted interventions, and the crucial role of combating corruption in public spending. Adopting a nuanced approach that integrates Keynesian and Wagnerian perspectives, coupled with a commitment to good governance and strong institutions, will be essential for maximizing the impact of economic policies and ensuring that the benefits of growth are shared equitably across all segments of Tunisian society.

7. Conclusion

This study explores how "public expenditure" and "national income" are connected in Tunisia. We put Wagner's law and Keynes' hypothesis to the test throughout our analysis. The results show that these two variables have a long-term equilibrium relationship and that there is a bidirectional Granger causality between them. Overall, our findings lend support to both the law and the hypothesis within the context of Tunisia.

The outcome of the result could be due to a general increase in public spending in various sectors of the Tunisian economy. For instance, in 2010, public investments represented 25% of the state budget and after the 2011 revolution, they only accounted for 3% of the state budget. Also, In 2019, the wage bill in the public sector amounted to 16,485 million dinars, representing 14.1% of GDP. The wage bill for public sector employees increased from 7,680 MD in 2011 to 13,700 MD in 2017 and then to 16,458 in 2019. Therefore, the evolution of

public spending during the period studied could also reveal that the Keynesian hypothesis is verified. However, a fairly high percentage of public spending has been directed towards economic growth. For this reason, public spending is often seen as a tool to stimulate economic growth, especially for developing economies.

The results of this research and previous studies prove that public spending is a tool of fiscal policy to revive the economy. This tool is adopted by policymakers. Based on Wagner's law, the government plays a significant role in achieving economic growth. The same has been advocated by Keynes' hypothesis regarding public spending. These interventionist policies are likely to increase the role of the state, thus causing bidirectional results between the two aggregates, hence the need to be cautious and responsible. To determine the extent to which state intervention is necessary, a compromise must be struck between the two objectives through the two variables. This is particularly essential to support other growth-generating policies.

Finally, the relationship between growth and public spending is a very important research theme. This investigation and previous research highlight in particular that this relationship is not linear. Indeed, beyond a well-defined threshold, public spending does not generate national income growth. This work has identified three thresholds for the study period. If national income increases, its relationship with public spending weakens. This implies that public spending is not the primary driver of national income growth for Tunisia. It is also worth noting that public debt is another independent source of public spending, which exceeds 40% (in years of political stability) to 80% of national income in 2019.

8. Declaration of conflicting interests

All authors declare that they have no conflicts of interest to disclose.

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