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Wagner's Law and Indebtedness in the Brazilian States

A Lei de Wagner e o Endividamento nos Estados Brasileiros

La ley de Wagner y la deuda en los estados brasileños

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Abstract

Objective: The objective of this paper is to verify the validity of Wagner's Law in Brazilian states and the evolution of indebtedness in these cases

Theoretical framework: In public finance, studies analyze budget balance and managers' perspective on revenue collection and expenditure execution. In this way, Wagner's Law considers that the expansion of a country's income leads to an increase in government expenditures.

Methodology: Elasticity was calculated, relating expenditure, GDP and population for the period from 2002 to 2021. The evolution of indebtedness in the Brazilian federation units was also analyzed, as well as the determining factors of this indebtedness through a panel model.

Results: Wagner's Law was valid in 35 (14%) of the situations examined, which can be considered a low frequency. In 19 (54%) of the 35 times the Law was valid, there was an imbalance in public spending with increased indebtedness in the studied federation unit. The correlation analysis and the non-significance of the estimation parameter of the panel model corroborate this result. We found that there was an imbalance in public spending with an increase in indebtedness in the studied federation unit.

Originality: We analyzed the behavior of public finances, with regard to Wagner's Law, in the federative units of Brazil, an object of study that was not identified in the previous works consulted.

Theoretical and practical contributions: We present empirical evidence that Wagner's Law was not associated with non-compliance with the fiscal debt limit. The results show the importance of monitoring the evolution of these indicators to avoid compromising public finances.

Keywords: Public spending, Fiscal Balance, Net Consolidated Debt.

Resumo

Objetivo da Pesquisa: O objetivo deste trabalho é verificar a validade da Lei de Wagner nos estados brasileiros e a evolução do endividamento nesses casos.

Enquadramento teórico: Nas finanças públicas, estudos analisam o equilíbrio orçamentário e a perspectiva dos gestores na arrecadação de receitas e execução de despesas. Nessa esteira, a Lei de Wagner considera que a ampliação da renda de um país leva ao crescimento das despesas do governo.

Metodologia: Foi calculada a elasticidade, relacionando despesa, PIB e população para o período de 2002 a 2021. Analisou-se ainda a evolução do endividamento nas unidades da federação brasileira, bem como os fatores determinantes desse endividamento por meio de modelo de painel.

Resultados: A Lei de Wagner foi válida em 35 (14%) das situações examinadas, o que pode ser considerada uma baixa frequência. Em 19 (54%) das 35 vezes em que a Lei foi válida, houve desequilíbrio nos gastos públicos com acréscimo de endividamento na unidade da federação estudada. Corroboram para esse resultado a análise de correlação e a não significância do parâmetro de estimação do modelo de painel. Constatou-se que houve desequilíbrio nos gastos públicos com acréscimo de endividamento na unidade da federação estudada.

Originalidade: O artigo analisa o comportamento das finanças públicas, no tocante à Lei de Wagner, nas unidades federativas do Brasil, objeto de estudo que não fora identificado nos trabalhos anteriores consultados.

Contribuições teóricas e práticas: O estudo traz evidências empíricas que a Lei de Wagner não se mostrou associada ao descumprimento do limite fiscal de endividamento. Os resultados evidenciam a importância de acompanhar a evolução destes indicadores para evitar o comprometimento das finanças públicas.

Palavras-chave: s: Gastos Públicos, Equilíbrio Fiscal, Dívida Consolidada Líquida.

Resumen

Objetivo de la Investigación: El objetivo de este trabajo es verificar la validez de la Ley de Wagner en los estados brasileños y la evolución del endeudamiento en estos casos.

Marco teórico: En las finanzas públicas, los estudios analizan el equilibrio presupuestario y la perspectiva de los administradores sobre la recaudación de ingresos y la ejecución de gastos. En este sentido, la Ley de Wagner considera que la expansión de los ingresos de un país conduce a un aumento de los gastos del gobierno.

Metodología: Se calculó la elasticidad relacionando gasto, PIB y población para el período de 2002 a 2021. También se analizó la evolución del endeudamiento en las unidades de la federación brasileña, así como los factores determinantes de este endeudamiento a través de un modelo de panel.

Resultados: La Ley de Wagner fue válida en 35 (14%) de las situaciones examinadas, lo que puede considerarse una frecuencia baja. En 19 (54%) de las 35 veces que la Ley estuvo vigente, hubo desequilibrio en el gasto público con aumento del endeudamiento en la unidad federativa estudiada. El análisis de correlación y la no significación del parámetro de estimación del modelo de panel corroboran este resultado. Se constató que hubo un desequilibrio en el gasto público con un aumento del endeudamiento en la unidad federativa estudiada.

Originalidad: El artículo analiza el comportamiento de las finanzas públicas, con relación a la Ley de Wagner, en las unidades federativas de Brasil, objeto de estudio que no fue identificado en los trabajos anteriores consultados.

Aportes teóricos y prácticos: El estudio aporta evidencia empírica de que la Ley de Wagner no estuvo asociada al incumplimiento del límite de endeudamiento fiscal. Los resultados muestran la importancia de monitorear la evolución de estos indicadores para evitar comprometer las finanzas públicas.

Palabras clave: Gasto público, Balance fiscal, Deuda Neta Consolidada.

1 INTRODUCTION

Public finances are the financial activities of the State that cover the raising of resources, their management, and allocation, aiming to meet and satisfy the needs of society (Pereira, 2003). Based on these assumptions, studies, and theories were developed to explain how the public sector operates in the economy, the emergence of public revenues, their evolution, and their relationship with the product and national income.

In this context, some studies analyze the budget balance and the perspective of public managers in revenue collection and expenditure execution. Some studies identify the government's methodology as "spend and collect" (Von Furstenberg, Green, & Jeong, 1986; Hakkio & Rush, 1991; Chang, 2002; Gamboa & Silva, 2004; Silva, Machado, Lopes, & Rebelo, 2010). Others observe that the behavior is "collecting and spending" (Baffes & Shah, 1994; Payne, 1998; Cheng, 1999; Chang, 2002; Afonso & Rault, 2009; Schettini, 2012; Linhares, Simonassi, & Nojosa, 2012). Another approach verifies the "fiscal synchronism" (Darrat, 1998; Cheng, 1999; Chang & Ho, 2002; Chang & Chiang, 2009; Linhares et al., 2012; Gadelha, 2011; Machado & Cavalheiro, 2020), according to which decision on expenditures and revenues are taken simultaneously. Empirical studies reached the result of "tax illusion" (Gemmell, Morrissey, & Pinar, 1999; Sausgruber & Tyran, 2005; Chetty, Looney, & Kroft, 2009; Dell'Anno & Mourão, 2012; Silva & Siqueira, 2014; Prado & Silva, 2018), which corresponds to budget decisions made amid conflicting interests between managers and taxpayer voters. With the collaboration of Adolph Wagner's studies, Wagner's Law (WL) became known at the end of the 19th century when it verified that there was a positive relationship between the income of a country and the expansion of the public sphere. That is, the increase in a country's income leads to impulses for the growth of government expenditures in the long term, leading to a rise in the demand for goods and services provided by the State (Prado & Silva, 2018). If the WL is valid and management behavior does not seek fiscal balance, the tendency will be to adopt the "spend and collect" methodology, favoring indebtedness.

Empirical studies verify and prove the validity of the WL for different countries and periods, including Brazil. Among them: Tobin (2005), Narayan, Nielsen and Smyth (2008), Verma and Arora (2010), Jaen-Garcia (2011), Bojanic (2013), Vieira (2014), and Bayrakdar, Demez and Yapar (2015), Nirola and Sahu (2020), Possa (2021), Nusair and Olson (2021) and Ghazy, Ghoneim and Paparas (2021); Inchauspe, MacDonald and Kobir (2022). However, some studies do not prove it, among which the following can be mentioned: Demirbas (1999), Günaydin (2000), Burney (2002), Chang (2002), Halicioğlu (2003), and Prado e Silva (2018). It is also noteworthy that recent literature approaches Wagner's Law opposing it to the Keynesian hypothesis (Sagndic, Unsaç & Tuncer, 2020; Cedillo & Herrera, 2021; Günay & Aygün, 2022; Sek, Sim, Chea & Hoe, 2022)

It is intended to fill a gap in the literature when dealing with WL within the scope of federative units. In each Brazilian state, the validity of the WL was analyzed through the elasticity result found in a simple systematic comparison between Public Expenditure, GDP, and Population, in the most current years, between 2002 and 2021. Furthermore, the period was selected considering the availability of data on fiscal management, which began with Complementary Law n° 101/2000, known as the Fiscal Responsibility Law (FRL), and sought to cover periods of crisis and economic recovery (after the international economic crisis of 2008 and the Brazilian crisis from 2014 to 2016).

Thus, the general objective of this study is to verify the validity of the WL in Brazilian states and the evolution of indebtedness in cases where the WL was valid. Given this, it is intended to answer the question: How does the indebtedness of federative units behave in Brazil, given the validity of the WL? The evolution of revenue, expenditure, and public debt in the federative units of Brazil between 2002 and 2021 was examined to answer this question.

The present study is justified by verifying how the public budget is conducted, given the balanced and efficient allocation of public money related to the situation of the national economy, having as pertinent themes the relationship between revenue and expenditure and WL in the examination of public finances.

Therefore, this research is useful because it complements studies on the WL and society's growing interest in information about public expenditures.

2 THEORETICAL REFERENCE

2.1 WAGNER'S LAW

Adolph Heinrich Gotthelf Wagner divulged his theory on increasing state expenditures and explained why (Wagner, 1883). Based on this theory, the doctrine established "Wagner's Law," which instituted a causality between two indicators: per capita income and public expenditure; that is, as a country increases its per capita income, the public sector increases in proportion and equivalent relevance (Bird, 1971).

Growth in government participation is driven in three ways: industrialization, income growth, and economic development. With industrialization and modernization, society must replace services provided by the public sector with private services. The complex social changes need gradual protection and systematization of the public situation. With a greater division of labor due to industrialization and urbanization, it must be necessary to increase spending to ensure the effective performance of the economy. Thus, to manage natural monopolies to increase economic efficiency, the government must change its system to the detriment of economic progress (Vieira, 2014).

After Wagner's works were translated into English and published in 1958, WL became much discussed in academia and tested by many researchers, such as Musgrave (1970), Bird (1971), Mann (1980), Henrekson (1993), Tobin (2005), Narayan et al. (2008), Jaen-Garcia (2011), Verma and Arora (2010), Bojanic (2013), Bayrakdar et al. (2015); Prado e Silva (2018); Nusair and Olson (2021); and Inchauspe, MacDonald and Kobir (2022).

Wagner, in the synthesis of his theory, was not so clear in forming a thesis and did not describe it mathematically. However, the authors tested the WL through different mathematical methods (Verma & Arora, 2010).

Since 1960, at least six WL interpretations have been empirically tested. However, no defined version states which one is the most appropriate. In this sense, as shown in Table 1, Afzal and Abbas (2010) summarize the most used WL test methods in research.

Table 1
Six Versions of Wagner's Law

Version	Functional Form	Version
1	$G = f(Y)$	Peacock-Wiseman (1961)
2	$G/P = f(Y/P)$	Gupta (1967)
3	$G = f(Y/P)$	Goffman (1968)
4	$GC = f(Y)$	Pryor (1969)
5	$G/Y = f(Y/P)$	Musgrave (1970)
6	$G/Y = f(Y)$	Mann (1980)

Source: Afzal and Abbas (2010), adapted by the authors.

Each coefficient indicates a variable considered to test the validity of the WL, where: G = Total government expenditure; Y = Gross Domestic Product (GDP); GC = Government Consumption; and P = Population (Afzal & Abbas, 2010).

The elasticity between total government spending and GDP was used to formulate Peacock and Wiseman's (1961) version. For Gupta (1967), the growth of real per capita government spending (G/P) depends on the growth of real GDP per capita (Y/P).

In the version tested by Goffman (1968), called the final version, total government expenditure was measured as a function of real per capita GDP growth, with population growth being irrelevant information for the theory. Similarly, Pryor's (1969) version used government consumption (GC) as a variable instead of total government expenditure.

In the models mentioned above, the WL is valid when the coefficient of elasticity is greater than one. Therefore, all expressions specified the WL in absolute terms (Verma & Arora, 2010).

In theory, Wagner supported the idea of relative growth. However, for Timm (1961), the WL must be interpreted to predict an increase in the relative participation of the public sector and the growth of per capita income. For Henrekson (1993), relative growth was based on the growing participation of the population and spending to the detriment of real per capita income.

In Musgrave's (1970) version, he formulated the mathematical expression considering the ratio between public spending in the sense and nominal GDP (G/Y) as a function of real GDP per capita (Y/P). In this case, the WL is valid if the elasticity is greater than or equal to one (Henrekson, 1993). Examples of authors who used this theory are Ram (1987), Khan (1990), Murthy (1993), and Hsieh and Lai (1994).

Mann (1980) modified the mathematical expression of Peacock and Wiseman (1961) and used real GDP as an independent variable, with WL valid when elasticity was greater than zero.

According to Vieira (2014), the easiest way to interpret and empirically test the WL is by relating GDP per capita to government expenditure. For this, several studies used time series for this purpose. However, in general, the studies presented a diversity in their results, prevailing the validity of the WL. This can be inferred from the main contributions of empirical research summarized in Table 2.

Table 2
Results of Wagner Hypothesis

Author	Methodology and Data	Wagner's Hypothesis
Ganti e Kolluri (1979)	OSL model was tested in the United States from 1929 to 1971.	Valid
Mann (1980)	Bivariate OLS model for data on the economy of Mexico between 1925 and 1976.	Valid
Yalçin (1987)	Aggregated data on Turkish public sector growth from 1963 to 1985.	Null
Demirbas (1999)	Engle and Ganger cointegration test for aggregated Turkish time series between 1950 and 1990.	Null
Alleyne (1999)	Cointegration and unit root tests for the Caribbean from 1953 to 1991, Guyana from 1950 to 1990, Barbados from 1960 to 1997, and Trinidad and Tobago from 1950 to 1991.	Null
Legrenzi e Milas (2002)	Cointegration test and Granger causality test. Data on the Italian economy in the period from 1959 to 1996.	Valid
Bojanic (2013)	Error correction model, cointegration, and causality analysis for Bolivian economic data between 1940 and 2010.	Valid
Silva e Siqueira (2014)	Unit root ADF tests, Johansen cointegration and error correction model in Brazil between 1990 and 2011.	Valid
Vieira (2014)	Autoregressive vector model, Granger causality analysis, cointegration test, and unit root test in Brazil from 1909 to 2004.	Valid
Bayrakdar et al. (2015)	Unit root test, cointegration, and Granger causality in Turkey from 1998 to 2004.	Valid
Prado e Silva (2018)	Autoregressive models of distributed lags and cointegration in Brazil, from 1997 to 2013.	Null
Nirola e Sahu (2020)	Unit root testing and cointegration in India after 1991.	Valid
Possa (2021)	Unit root tests and Granger causality in Brazil from 1997 to 2019.	Valid
Nusair e Olson (2021)	Granger causality test and asymmetric nonlinear in Gulf Cooperation Council countries.	Valid
Ghazy, Ghoneim e Pappas (2021)	Unit root tests, Johansen cointegration, and Granger causality in Egypt from 1960 to 2018.	Valid
Inchauspe, MacDonald e Kobir (2022)	Autoregressive vector model and cointegration test in Indonesia from 1980 to 2014.	Valid

Source: own elaboration.

If the WL predicts the evolution of public spending on a scale greater than national income, the State goes into debt by borrowing to support fiscal deficits (Buchanan & Wagner, 1977).

Regarding the collection and allocation process, part of the literature identifies that the government's methodology is "spend and collect" (Von Furstenberg et al., 1986; Hakkio & Rush, 1991; Chang, 2002; Gamboa & Silva, 2004; Silva et al., 2010). Others identify the result of "raising and spending" (Baffes & Shah, 1994; Payne, 1998; Cheng, 1999; Chang, 2002; Afonso & Rault, 2009; Schettini, 2012; Linhares et al., 2012).

Another line of literature argues that fiscal policy is based on "fiscal synchronism" (Darrat, 1998; Cheng, 1999; Chang & Ho, 2002; Chang & Chiang, 2009; Linhares et al., 2012; Gadelha, 2011; Machado & Gentleman, 2020). Other empirical studies reached the result of "tax illusion" (Gemmell et al., 1999; Sausgruber & Tyran, 2005; Chetty et al., 2009; Dell'anno & Mourão, 2012; Silva & Siqueira, 2014; Prado & Silva, 2018).

Recent literature reinforces the perception that the current discussion orbits around the validity of Wagner's Law in contrast to the Keynesian hypothesis, such as Günay and Aygün (2022), Sek, Sim, Chea

and Hoe (2022) and Sagndic, Unsaç and Tuncer (2020). In addition, the study by Cedillo and Herrera (2021) stands out, which focused their contributions on 16 Latin American countries between 1990 and 2017. The results support WL in the long term, highlighting the need for the State to direct public spending to meet social demands and, in this way, boost the economy. In the same line of confronting the WL with the Keynesian hypothesis, in the sense that, respectively, public spending varies endogenously and exogenously as a function of economic growth, Chu and Lin (2021) show that the two points of view coincide as consumption private and public spending become substitutable.

The validity of the WL demonstrates its current scientific importance in local terms, such as the studies of Bendahmane and Chenini (2021), who tested the six versions for Algeria; Nirola and Sahu (2020), who explained the reality of India; and Ghazy, Ghoneim and Paparas (2021) who demonstrated it in Egypt.

From the above, it was clear that the topic is still current and that a relevant gap to be filled is to verify whether public spending is unbalanced, that is, whether it is growing more sharply and generating indebtedness.

2.2 Net Consolidated Debt and Debt Limits

The FRL established norms for fiscal control, with the main objective of controlling indebtedness and curbing the State's public deficits.

For the period studied, the debt limits are stipulated in Federal Senate Resolutions nº 40 and nº 43, both from 2001, and have as a parameter the Net Consolidated Debt (NCD), which represents the amount of the consolidated public debt minus the amounts cash, financial investments, and other financial resources (Brasil, 2001). Such limitations and others provided for in the FRL may favor fiscal balance (Macedo & Corbari, 2009; Linhares, Penna, & Borges, 2013). Furthermore, a virtuous cycle is generated when the funded resource is allocated to capital expenditures (Simonassi, Gondim Filho, & Arraes, 2022). However, the expenditure profile can also influence, for example, when personnel expenses are high. In this case, the budget is committed to paying salaries, which may lead to a decrease in the budget result and increasing indebtedness (Cassimiro, Nascimento, & Viotto, 2021).

Therefore, monitoring the DCL and its fiscal limit – which are available respectively in the financial statements and in the fiscal statements of public entities – are relevant aspects for controlling public finances. In addition, it is useful to observe their evolution to characterize eventual budgetary imbalances.

2.3 Economic Expansion and Public Spending

As already highlighted, for Wagner, the increase in public spending drives a series of side effects that affect the performance of a given country's economy, a condition that favors an increase in GDP (Vieira, 2014).

In economic development, total public spending tends to increase concerning national income, the justification given by the fact that the increase in public spending is a natural consequence of the growth of economic activity, a circumstance that underlies the WL (Bender Filho, 2019).

According to Marques Júnior, Oliveira and Jacinto (2006), exogenous factors, such as population growth and technological advances, limit economic growth, as government spending and taxation variations have temporary effects. Thus, in the short term, the fall in public spending reduces GDP, but in the long term, if the government spends less, the balance of wealth generated will be greater, and, as a result, GDP will increase.

Several studies analyze the relationship between public spending and economic development, identifying aspects that can influence it. Bogoni, Nelson, and Beuren (2011) highlighted that spending on health, sanitation, education, culture, housing, social assistance, and social security is essential to economic growth. On the other hand, Silva and Scatolin (2012) indicate that public spending on infrastructure positively implies economic growth. Silva and Triches (2014) conclude that the high productivity of the main public expenditures increases the final economic product. Finally, Leite Filho and Fialho (2015) point out that the quality of public management positively influences economic development.

On the other hand, Sousa, Rosa and Ribeiro (2020) identified that health and sanitation, urban planning, and housing and education expenses do not affect economic growth, which differs from the results obtained in the studies presented in the previous paragraph. This same study indicates that the increase in total current expenditure is related to the reduction in GDP. Therefore, a possible explanation for this difference in results may be the expenditure profile of the municipalities studied, which is less focused on infrastructure expenditures which, as already highlighted (Silva & Scatolin, 2012), positively influence economic growth.

From these studies, it is observed that there is a direct relationship between the concepts discussed in this subsection and that it is possible to have economic development and growth in public spending, maintaining the government's fiscal balance. However, without expanding indebtedness, the imbalance scenario would no longer be favorable to economic growth.

Given the above, the following research hypothesis is formulated: in Brazilian states, the WL is valid with high frequency, and there is no fiscal balance of government management, favoring the growth of indebtedness.

3 METHODOLOGY

This research is classified as descriptive with a quantitative approach since, to obtain the results, it makes predominant use of descriptive and inferential statistical resources from a database.

The database was collected from secondary sources from the National Treasury of Brazil (STN) website in the Brazilian Public Sector Accounting and Tax Information System (SICONFI). In addition, GDP and population were also researched by state, with information available at the Brazilian Institute of Geography and Statistics (IBGE). Finally, monetary variables were capitalized at the present value of December 2021 based on the Extended National Consumer Price Index (IPCA), also released by the IBGE.

The documents in which the data are contained are the accounting and tax statements found in the Summary Report of Budget Execution (RREO) for the 26 states and the Federal District between 2002 and 2021. The Statement of Nominal Income (from which DC values were obtained), the Statement of Net Current Revenue (RCL), and the Budget Balance stand out.

After collecting data, the WL's validity was verified in all Brazilian states and the Federal District (to simplify, from now on, only the word *state* will be used) from 2002 to 2021. The WL was tested based on the proposal of Musgrave (1970) through the function defined as $G/Y=f(Y/P)$, where: G = Expense, Y = GDP, and P = Population. From the relationship between G/Y (which was called "X") and Y/P (which was called "Z"), calculate the elasticity defined by the following equation:

$$\text{Elasticity} = \left(\frac{X_t - X_0 / X_0}{Z_t - Z_0 / Z_0} \right)$$

(1)

The elasticity reflects the percentage change over time of "X" given the percentage change of "Z." With this, it was possible to know what happens to "X" when "Z" varies by 1%, that is, what happens to the Expense/GDP ratio when the GDP per capita ratio goes by a percentage unit.

The relationship between "X" and "Z" can be negative, positive, or unitary. If the elasticity is positive and greater than 1, a 1% increase in Y/P results in a greater than 1% increase in G/Y ; This is the condition for the WL to be valid since it indicates that the percentage change in per capita income is increasing public spending more than proportionally. Then, the two series Expense/GDP and GDP per capita were

compared, as well as the correlation index between these two variables over time was calculated with the aid of STATA.

It is important to highlight the methodological limitation resulting from the small sample. We tried to expand this research database as much as possible so that it was possible to reliably estimate parameters obtained by regression of time series, necessary for cointegration and causality tests observed in the literature. However, the periodicity of the state data is annual, which restricted the sample size to 20 observations for each state without considering the loss of natural observations in autoregressive models and in the stationarity process of time series.

Nevertheless, the calculation of elasticity and the analysis of the evolution of G/Y and Y/P shed light on the validity of WL in the Brazilian states, which proves to be an important contribution, considering that the studies that proposed to test the WL did not stratify the sample at the level of Brazilian states, like Bender Filho (2019) and Vieira (2014).

In a second moment, the determining factors of the indebtedness of the states were analyzed. For this, panel data modeling was used, with the aid of STATA, based on the following mathematical model:

$$DCL_{it} = \beta.DCL_{i(t-1)} + \beta.GDP_{i(t-1)} + \beta.Expenses_{i(t-1)} + \beta.Revenues_{i(t-1)} + \beta.WL_{it} + \varepsilon_{it}$$

(2)

The

variable, which corresponds to the Net Consolidated Debt lagged by one period, was inserted in the model to confirm that the current indebtedness stems from a stock of debt, at least from the previous year.

The real GDP also lagged in a period since it is arguable that the country's economic result contributed to the reduction of indebtedness only from the following period.

Variations in current state revenues and expenditures for a given period may favor an increase or decrease in future DCL. For this reason, these variables were adjusted by the IPCA and lagged by a period.

Finally, the variable WL_{it} corresponds to a dummy that captures the effect of the validity of the WL, calculated through elasticity, to which 1 was assigned if the WL was valid for a given State and year; and 0, otherwise.

4 RESULTS AND DISCUSSIONS

In this chapter, the analysis and interpretation of the variables for the validity of the WL will be presented, as well as the examination of the debt index in the 26 Brazilian states and the Federal District from 2002 to 2021.

4.1 Analysis of the Validity of Wagner's Law

During the analyzed period, the WL was valid 67 times. Twenty years of 27 states were analyzed, resulting in a sample space of 540 observations. However, considering that the variation calculation requires one observation per state and some GDP and population data are unavailable, the final sample analyzed consisted of 512 observations.

From these findings, observing which Brazilian states the WL was valid is opportune. Table 3 shows the summary of the frequency of times the WL was valid, as well as the percentage of this frequency concerning the sample of each state and the years in which the validity of the WL was observed.

Table 3: Frequency of validity of Wagner's Law by state

Table 3
Frequency of validity of Wagner's Law by state

States	Var. % 2002-2021	Years that exceeded the tax limit
Acre	51.72	-
Alagoas	-57.68	2002, 2003, 2004, 2005, 2006 and 2007
Amapá	-162.40	-
Amazonas	-21.94	-
Bahia	-53.60	-
Ceará	-19.81	-
Distrito Federal	19.37	-
Espírito Santo	-101.79	-
Goiás	-55.18	2002, 2003 and 2004
Maranhão	1450.47	-
Mato Grosso	-129.72	2002
Mato Grosso do Sul	-79.74	2002, 2003, 2004 and 2005
Minas Gerais	38.36	2002, 2003, 2004 and 2005
Pará	-93.20	-
Paraíba	-104.72	-
Paraná	-70.35	-
Pernambuco	-26.16	-
Piauí	-29.14	-
Rio de Janeiro	50.85	2002 to 2004 and 2016 to 2020
Rio Grande do Norte	6.76	-
Rio Grande do Sul	36.60	2002 to 2020
Rondônia	-113.83	-
Roraima	-121.03	-
Santa Catarina	-37.08	-
São Paulo	-8.90	2002, 2003 and 2004
Sergipe	-23.64	-
Tocantins	24.81	-
Average	13.67%	

Source: Own elaboration.

Of all the federation states, only in Alagoas was the WL not valid in any verified years. On the contrary, the highest frequency was in Amapá, where the WL was valid in 6 of the 20 years studied. However, even in this case, the WL was not valid for most of the period examined. Regarding the period, according to Table 4, it is possible to identify that in 2008 and 2016, the WL was valid more frequently.

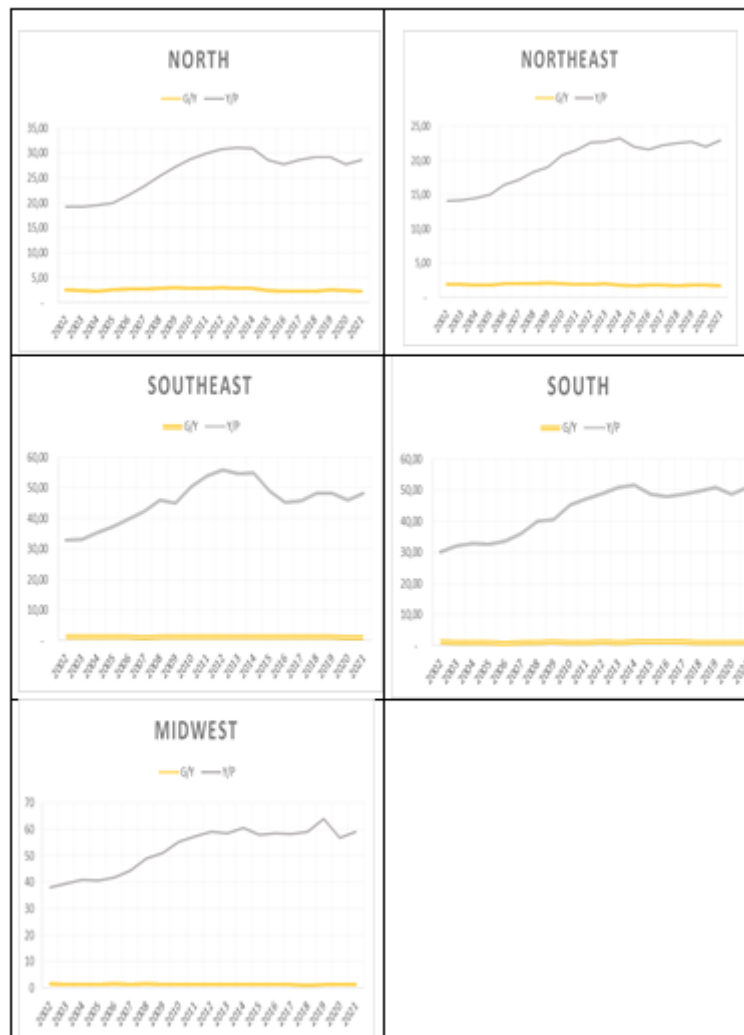
Table 4
Frequency of validity of Wagner's Law per year

Year	Frequency
2003	2
2005	8
2006	2
2007	9
2008	11
2010	2
2012	3
2013	2
2014	5
2015	3
2016	11
2018	1
2019	7
2020	1

Source: Own elaboration.

Interestingly, the years 2008 and 2016 were marked by the outbreak of the global financial crisis that started in American banks and the deepening of the Brazilian economic crisis, marked by the recession that year. This situation, combined with the fiscal crisis in the Brazilian states, which was already more pronounced, can be considered a favorable scenario for the associated expansion of the studied variables.

Figure 1: Evolution of G/Y and Y/P by Brazilian region.



Source: prepared by the authors.

Figure 1 shows the evolution of the G/Y ratio concerning GDP per capita in December 2021. State data were aggregated by region according to the average to facilitate interpretation. Therefore, for the WL to be valid, the G/Y ratio should, at least, follow the Y/P ratio, thus demonstrating a directly proportional relationship. However, it is observed, for all regions, that this did not occur, reinforcing the results obtained by calculating the elasticities.

In general, the trend of the G/Y ratio is slightly decreasing to constant, indicating that public spending does not show strong fluctuations around GDP. On the other hand, the evolution of per capita GDP has an increasing trajectory over time, with a certain stagnation from 2012 onwards. Before that, attention was drawn to the reduction in per capita GDP, observed mainly in the Southeast in 2014, due to the Brazilian economic crisis. The Midwest region, in turn, stabilized its growth curve during the crisis but did not show signs of recession, a behavior that can be explained by the strong dependence of the region's GDP on agribusiness.

In search of more evidence confirming the validity or otherwise of the WL for the Brazilian states in the sample period, Table 5 brings the Pearson correlation index between the G/Y and Y/P variables. Following the logic of elasticity, from the perspective of an index that represents all the years studied, for the WL to be valid, there must be a high positive correlation between G/Y and Y/P, indicating variations in G/Y following the same proportion as variations in Y/P.

Table 5
Pearson correlation index by state between GY and YP

States	Correlations
Acre	0.4615
Alagoas	-0.4825
Amapá	0.2262
Amazonas	0.3744
Bahia	0.0319
Ceará	-0.8189
Distrito Federal	-0.3422
Espírito Santo	-0.3318
Goiás	-0.5885
Maranhão	-0.0508
Mato Grosso	-0.6337
Mato Grosso Do Sul	-0.5392
Minas Gerais	0.2920
Pará	0.1970
Paraíba	-0.6504
Paraná	0.3388
Pernambuco	0.5019
Piauí	-0.5375
Rio de Janeiro	0.0351
Rio Grande do Norte	0.1047
Rio Grande do Sul	0.5821
Rondônia	-0.0632
Roraima	0.2721
Santa Catarina	-0.7478
São Paulo	0.2836
Sergipe	0.3108
Tocantins	-0.7417

Source: prepared by the authors.

The results, however, point to the rejection of the hypothesis that the WL is valid for the Brazilian states. It is noted that, in 13 states, the correlations were negative, with emphasis on Ceará (-0.8189), Santa Catarina (-0.7478), and Tocantins (-0.7417). By this analysis, only Rio Grande do Sul and Pernambuco would have some success in validating the WL, but it is still questionable since they reached positive but moderate correlations of 0.5821 and 0.5019, respectively.

Therefore, even with low frequency, there were situations in which the WL was valid, giving rise to a joint assessment of its indebtedness, the subject of the following topic, which can denote whether the expansion of public spending was balanced.

4.2 Debt Analysis

From the findings in Table 6, the behavior of the indebtedness of the States is shown, which, on average, presented an increase between 2002 and 2021 of 13.67%, with emphasis on Maranhão (+1450%), Acre (+51.72%), Rio de Janeiro (+50.85%), Amapá (-162.40%), Mato Grosso (-129.72%) and Roraima (-121.03%). In the analyzed period, the fiscal limit established in the Resolution of the Federal Senate, of twice the RCL, was exceeded 49 times, with emphasis on Rio Grande do Sul, which historically always exceeded this limit, Rio de Janeiro, which exceeded it eight times and Alagoas which exceeded six times.

Table 6: Debt variation between 2002 and 2021 and the years in which the states exceeded the tax limit

Table 6

Debt variation between 2002 and 2021 and the years in which the states exceeded the tax limit

States	Var. % 2002-2021	Years that exceeded the tax limit
Acre	51.72	-
Alagoas	-57.68	2002, 2003, 2004, 2005, 2006 and 2007
Amapá	-162.40	-
Amazonas	-21.94	-
Bahia	-53.60	-
Ceará	-19.81	-
Distrito Federal	19.37	-
Espírito Santo	-101.79	-
Goiás	-55.18	2002, 2003 and 2004
Maranhão	1450.47	-
Mato Grosso	-129.72	2002
Mato Grosso do Sul	-79.74	2002, 2003, 2004 and 2005
Minas Gerais	38.36	2002, 2003, 2004 and 2005
Pará	-93.20	-
Paraíba	-104.72	-
Paraná	-70.35	-
Pernambuco	-26.16	-
Piauí	-29.14	-
Rio de Janeiro	50.85	2002 to 2004 and 2016 to 2020
Rio Grande do Norte	6.76	-
Rio Grande do Sul	36.60	2002 to 2020
Rondônia	-113.83	-
Roraima	-121.03	-
Santa Catarina	-37.08	-
São Paulo	-8.90	2002, 2003 and 2004
Sergipe	-23.64	-
Tocantins	24.81	-
Average	13.67%	

Source: prepared by the authors.

Table 7 compares the state's public debt growth and fiscal limit, the years in which the WL was valid, and there was an increase in indebtedness.

Table 7
Wagner's Law validity and indebtedness

Order	State	Year	Debt Growth	Tax Limit DCL/RCL
1	Acre	2006	20.07	0.4959
2	Amapá	2007	2.40	0.0959
3	Amapá	2014	67.61	0.4120
4	Amapá	2019	2.982.67	0.3458
5	Amapá	2020	24.05	0.3969
6	Distrito Federal	2013	158.85	0.1608
7	Distrito Federal	2015	16.51	0.2523
8	Distrito Federal	2016	19.25	0.2989
9	Espírito Santo	2018	16.91	0.1895
10	Minas Gerais	2007	2.73	1.8775
11	Minas Gerais	2015	8.91	1.9865
12	Paraná	2005	28.30	1.2087
13	Paraná	2008	33.46	1.1870
14	Piauí	2019	15.17	0.5471
15	Rio Grande do Norte	2016	38.19	0.1240
16	Rio Grande do Sul	2008	3.38	2.3447
17	Rio Grande do Sul	2014	2.20	2.0911
18	Rio Grande do Sul	2016	0.72	2.1294
19	Rondônia	2013	45.65	0.6586
20	Roraima	2005	356.79	0.1537
21	Roraima	2019	33.21	0.3874
22	Tocantins	2010	60.32	0.1636
23	Tocantins	2014	36.39	0.3267

Source: prepared by the authors.

Note: Tax limit met if $DCL/RCL \leq 2.00$.

From Table 7, it is concluded that, in 23 (34.33%) of the 67 times in which the WL was valid, there was an increase in the indebtedness of the studied federation unit. Thus, "fiscal synchronism" was not observed in these cases, in which the tendency would be the "spend and collect" methodology.

It is worth mentioning the high growth of the debt in Amapá, whose balance in 2018 was BRL 60,719,662.15, and in the following year, it increased to BRL 1,933,086,021.15, as shown in the SICONFI database. Consulting the Tax Management Report for this state, the increase occurred in Remains Payable Processed.

Also noteworthy are the Federal District and Rio Grande do Sul, which, on three occasions, showed an imbalance in public spending. In the case of Rio Grande do Sul, the evolution was not as expressive as in the Federal District; however, its fiscal debt limit was not met. Therefore, this scenario, in which there is an economic expansion, and public spending grows unbalanced, with indebtedness, is not favorable and may compromise the sustainability of the actions developed by this government, as advocated by Bogoni et al. (2011), Silva and Santolin (2012), Silva and Triches (2014) and Leite Filho and Fialho (2015)).

Through the descriptive analysis of the data, a low frequency of validity of the WL was identified in the Brazilian states, which led to reject the hypothesis of this research. In 34% of the cases in which it was valid, the indebtedness grew, showing an imbalance in public spending with an increase in indebtedness. In this situation, the tendency is to execute public expenditures to collect resources later to pay the future debts caused by this behavior. Furthermore, it was found that, of the 49 times in which the indebtedness limit was exceeded in the states, only on 3 of these occasions was the WL valid, allowing us to deduce that there was no relationship between these variables, that is, in the period studied, other aspects acted as drivers of non-compliance with the fiscal limit.

The regression results show that, except WL, all model variables influence DCL variations.

Table 8
Result of the regression analysis

	DCL _{i(t-1)}	GDP _{i(t-1)}	Expense _{i(t-1)}	Revenues _{i(t-1)}	WL _{it}
Expected outcome	+	-	+	-	Don't follow
β_n	0.9202	-90.6866	1.0373	-0.0123	3.25e+08
Standard error	0.0303	4.9905	0.0304	0.0037	2.15e+08
p-value	0.0000	0.0000	0.0000	0.0001	0.1320
Meaningfulness	***	***	***	***	
Result	+	-	+	-	Don't follow

*Model remarks: Significance level: *** 0.01; ** 0.05; * 0.10; Prob F=0.000; R2= 0.9566; R2adjusted= 0.9562; Brusch Pagan test: p-value 0.99 (does not reject the pooled model hypothesis). Unbalanced panel due to lags. Sample size: 509 observations.*

The lack of significance of the WL is consistent with the result of Prado and Silva (2018), who carried out tests for Brazil without stratifying by state, identifying that the WL was null and contradicted the results of Silva and Siqueira (2014), Vieira (2014), Bendahmane and Chenini (2021) and Possa (2021) who, with the same object of study, but in a longer and different time interval, identified the validity of the WL for Brazil. This result indicates a tendency away from the "collect and spend" methodology (Afonso & Rault, 2009; Payne, 1998; Baffes & Shah, 1994; Chang, 2002).

Findings like those found in this research were also identified in other countries, such as Yalçin (1987), Demirbas (1999), and Alleyne (1999). On the other hand, the results contradict those of Ganti and Kolluri (1979), Mann (1980), Legrenzi and Milas (2002), Bojanic (2013), Bayrakdar et al. (2015), Nirola and Sahu (2020), Nusair and Olson (2021), Ghazy, Ghoneim and Paparas (2021), who concluded that WL is valid in countries other than Brazil.

Bearing in mind that the time interval studied in the present research refers to a period after the FRL, the fiscal balance sought with the dictates of this rule (such as the golden rule and the restrictions for contracting credit operations by anticipated budget revenue - ARO) may be influencing this result, as identified by Macedo and Corbari (2009) and Linhares et al. (2013).

This scenario may also have been influenced by contracting debt, whose profile is the linkage of the funded resource, as advocated by Simonassi et al. (2022), and by the profile of expenditures with more limited expenses in the budget Casimiro et al. (2021).

5 CONCLUSION

The present work aimed to verify the validity of the WL in the Brazilian states and its impact on indebtedness; for this purpose, the validity of the WL was tested based on the premise of Musgrave (1970), as well as the indebtedness between 2002 and 2021.

The results indicated a low frequency of validity of the WL (13.09%), and when valid, only 34.33% of the time, there was an increase in debt, denoting an imbalance in public spending and a tendency to make public spending and then collect. Notably, only in three cases in which the WL was valid did the increase in debt cause non-compliance with its fiscal limit of twice the RCL, provided for in Federal Senate Resolution No. 40 of 2001; This indicates that non-compliance with debt limits must not be associated with the WL, because of the 49 times the fiscal limit was exceeded, in only 3 the WL was valid.

This research presents as its main contribution the analysis of the behavior of public finances regarding the WL in the federative units of Brazil, an object of study that had not been identified in the previous works consulted. In addition, these results highlight the importance of monitoring the evolution of these indicators to avoid compromising public finances. Furthermore, considering the cumulative process of scientific knowledge, this work corroborates the results of Prado and Silva (2018). It should also be noted that this research showed a panel of previous studies on the subject, verifying that the results are antagonistic.

Bearing in mind that this research dealt with elasticity with a simple systematic comparison between Public Expenditure, GDP, and Population, it is suggested that future studies consider more robust econometric models, such as panel data, for example, to establish the causality relationship between these variables and indebtedness, whose signs have already been identified in this work.

It is also expected that further research will expand the time horizon and deepen discussions on the relationship between Wagner's Law and other aspects, in addition to indebtedness, such as the types of expenses that were increased, the effectiveness of government management, and the theory of political cycles.

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