Indian Journal of Economics and Finance (IJEF)
ISSN: 2582-9378 (Online), Volume-4 Issue-1, May 2024

Exploring Wagner's Law in India: An Empirical Study of Economic Growth and Public Expenditure

Jasneet Kaur Wadhwa, Srividya Subramaniam

Abstract: ***In this research paper, we test the connections between public spending and economic growth in India by employing annual data from 1981-82 till 2019-20. We examine if there is a long-run relation between public spending and economic growth and then we try to understand the direction of causality between them by using six versions of Wagner's law along with an augmented version. The paper employs tests of stationarity, cointegration, granger causality and the vector error correction model for the analysis in all the versions. Results from these tests show that only some versions give support to validate Wagners' law in India over the sample period studied.***

Keywords: Economic Growth; Public Spending; Cointegration; Granger Causality; India

I. INTRODUCTION

India, being one of the world's fastest-growing economies, has experienced significant changes in its public expenditure patterns over time. It is essential to comprehend the relationship between economic growth and public spending in India due to the country's varied and intricate socioeconomic structure. Examining the applicability of Wagner's Law in India can provide valuable insights into the dynamics of public expenditure and its impact on the country's economic development. According to Wikipedia, "Wagner's law, also known as the law of increasing state activity, is the observation that public expenditure increases as national income rises. It is named after the German economist Adolph Wagner (1835–1917), who first observed the effect in his own country and then for other countries". Wagner was among the few to identify the positive relationship between economic growth and the government's sector size and to illustrate it through empirical evidence.

The fundamental premise of Wagner's Law is that as societies progress and become wealthier, there is growth in demand for public goods and services, including infrastructure, education, healthcare, social welfare, law enforcement, regulatory bodies, and other mechanisms aimed at maintaining social order. This increased demand leads to an expansion of government activities, job creation, and a rise in public expenditure to fulfil the needs of society.

Manuscript received on 30 April 2024 | Revised Manuscript received on 14 May 2024 | Manuscript Accepted on 15 May 2024 | Manuscript published on 30 May 2024.

**Correspondence Author(s)*

Dr. Jasneet Kaur Wadhwa, Associate Professor, Department of Economics, SGTB Khalsa College, University of Delhi, New Delhi India. E-mail: jasneetkw@sgtbkhalsa.du.ac.in, ORCID ID: 0000-0003-4028-0062

Dr. Srividya Subramaniam*, Associate Professor, Department of Economics, SGTB Khalsa College, University of Delhi, New Delhi India. E-mail: srividyadse@gmail.com

Investments in infrastructure can improve economic productivity and attract further private-sector investments. Because there was no clear mathematical formula, multiple scholars used various variations to assess the validity of Wagner's Law. The six original modelling versions of Wagner's law were formulated by Peacock and Wiseman , 1961, [25], Gupta, 1967, [9], Pryor, 1969, [26], Goffman, 1968, [7], Musgrave, 1969, [20] and Mann, 1980, [16]. There is yet another model, the Augmented Version which was originally formulated by Murthy,1994, [18], quoted by Halicioglu, 2003, [10], Magazzino, 2012, [15] and Alimi, 2013, [3] in their respective papers. The Peacock-Wiseman version explains public expenditure as a function of gross domestic product (GDP), while Pryor's perspective focuses on public consumption expenditure as a function of GDP. Goffman's approach considers public expenditure as a function of per capita GDP. Musgrave's version indicates that per capita GDP explains the share of public expenditure to GDP. Gupta's model suggests that per capita public expenditure is a function of per capita GDP and finally, Mann's formulation of Wagner's law explains the growth of public expenditure in terms of the GDP growth. In Murthy's model (1993,1994, [18,19]) of augmented Wagner's Law, the equation typically includes additional variables such as public deficit, beyond the traditional factors considered in Wagner's Law. This augmented model aims to provide a more comprehensive analysis of the impact of economic factors beyond GDP per capita on government spending patterns. The augmented version gives a holistic framework in the given economic context that explains a long-term association between government expenditure with economic growth and deficit variables.

This diversity of interpretations, along with the use of different variables, methodologies, and time periods, has resulted in varying empirical findings. In this context, this study aims to explore the relationship among government spending and economic growth in India by examining different versions of Wagner's law and their corresponding empirical testing methodologies. By analyzing the available data and considering the various factors at play, we can gain a deeper insight into the complex dynamics between public expenditure and GDP.

The study has two objectives. First, determine whether there exists a long-term relationship between public spending and economic growth. If a long-run linkage is confirmed, the next step is to examine the direction of causality between these two variables in both the long and short runs. The layout of this paper is as follows.

We briefly review the current literature in this area, both in India and overseas. Section 2 is literature review. Section 3 describes the models to be estimated as well as data sources used. Section 4 discusses the methodology and outcomes, while section 5 concludes the paper.

II. LITERATURE REVIEW

The relation between public expenditures and GDP has been extensively studied in various countries, yielding diverse findings. For instance, Tesařová, 2020, [30] confirmed Wagner's law in the long term for three countries in the Visegráds Four, except for Slovakia, which displayed a bi-directional relationship not supporting Wagner's law. Najarzadeh & Khorasani, 2019, [21] found Wagner's Law applicable in Iran, while Ogbonna, 2015, [24] found no evidence of support for the law in Greece. Kesavarajah,2012, [14] identified a short-term relation between governmental spending and economic growth in Sri Lanka. Afzal and Abbas, 2010, [1] found support for Wagner's law in Pakistan only during a specific period. In China, Narayan et al.,2008, [22] found mixed evidence supporting Wagner's law in different provinces.Ahuja and Pandit's, 2020, [2] study re-examined the relation between public expenditures and economic growth using an extensive panel dataset covering 59 countries from 1990 to 2019, confirming a unidirectional causality running between economic growth and Public Spending. The causation runs from public spending to GDP growth. Sharma and Singh, 2019, [28] found evidence of support for Wagner's law in India in the long term, while Budhedeo, 2018, [4] did not. Medhi,2014, [17] also found unidirectional causality in Public Spending and GDP, thus supporting the law.

Gangal and Gupta,2013,[6], Srinivasan, 2013, [29], and Narayan et al., 2012, [23][33] also found evidence in support of Wagner's law in India. Javed and Khan, 2021, [12] found supporting evidence for Wagner's hypothesis, indicating a long-run relation between GDP and public expenditure, with causality being uni-directional from GDP to public expenditure. Additionally, Sharma and Sundaram's study, 2021, [27] using an extended dataset found a positive elasticity of growth rate in expenditure with respect to the first difference of per capita GDP, providing support for Wagner's hypothesis.

Alimi,2013, [3] conducted a study in Nigeria to validate Wagner's hypothesis. The results indicated that there is a long-term tendency for public expenditure to increase relative to national income, suggesting it as an endogenous factor. In addition, the study examined an expanded version of Wagner's Law, incorporating the public deficit as another explanatory variable. The analysis revealed a two-way causal relationship in the short term in five out of seven instances. In the long term, Wagner's hypothesis was found to be more appropriate than the Keynesian one.

A study conducted by Magazzino, 2012, [15] analyzed the empirical evidence of Wagner's Law and its augmented version in EU-27 from 1970-2009. The findings supported the Wagnerian hypothesis for developing countries, emphasizing the role of aggregate income in determining public expenditure in the initial stages of the development process. Contrarily, there seemed to be no clear evidence of government expenditures causing growth in national income, challenging the Keynesian perspective. The study suggests exploring new augmented versions of the law to account for relevant omitted variables.

The empirical validity of Wagner's law was not supported in Halicioglu's, 2003, [10] analysis of Wagner's hypothesis in Turkey from 1960-2000. However, when he employed the augmented version, he found statistical evidence of support, indicating a positive long-run relationship between government expenditure as a share of GDP and real per capita income growth. These studies demonstrate a comprehensive understanding of the correlation between government spending and the growth of an economy. While there are varying opinions on the validity of Wagner's law, the study emphasizes the significance of further investigation and analysis to comprehend this relationship within the Indian context.

III. DATA AND MODEL

The various versions of Wagners' law tested in this study consist of the six broad versions of the Wagners law studied in the literature along with the augmented version.

Model 1-Peacock-Wiseman, 1961, [25] version - where Expenditure = f(GDP) i.e. total government expenditure is a function of GDP. This is estimated as a double log-linear form (L is natural log, a, b and c are coefficients reflecting the impact of each variable on government expenditure and e is the random error term in all models) as

$$L(E)= a + b\ L\ (G) + e.$$

Model 2-Gupta, 1967, [9] version- where i.e. per capita expenditure = f (per capita GDP) i.e. per capita expenditure is a function of per capita GDP. This is estimated in double log-linear form as

$$L\ (E/P) =a + b\ (L\ (G/P)) +e.$$

Model 3-Goffman, 1968, [7] version -
where expenditure= f (per capita GDP) i.e. expenditure is a function of per capita GDP, to be estimated in double log-linear form as

$$LE= a + b\ (L\ (G/P)) + e$$

Model 4-Pryor, 1969, [26] version - where government consumption=f (GDP), i.e. government consumption expenditure is a function of GDP.

This is estimated in double log-linear form as

$$LC = a + b\ LG + e$$

Model 5-Musgrave, 1969, [20] version- where the share of expenditure in GDP is a function of per capita GDP.
This is estimated in double log-linear form as

$$L(E/GDP)=a + b(L(GDP/P))+e$$

Model 6-Mann, 1980, [16] version-where the share of expenditure in GDP is a function of GDP. This is estimated in double log form as

$$L(E/GDP) = a + b\ L(GDP) + e$$

For Wagner's law to be valid the real income elasticity coefficient(b) in the Peacock Wiseman, Goffman and Pryor versions which are the non-ratio versions should be larger than 1 and larger than zero in the ratio versions which are Gupta, Musgrave and Mann versions and causality should be from the economic growth variable to the expenditure variable.(Iyare and Lorde, 2004, [11]).

Retrieval Number:100.1/ijef.A257404010524
DOI:10.54105/ijef.A2574.04010524
Journal Website: www.ijef.latticescipub.com

Published By:
Lattice Science Publication (LSP)

Augmented Wagner Law

In Murthy's model of augmented Wagner's Law, the equation typically includes additional variables beyond the traditional factors considered in Wagner's Law. This augmented model aims to provide a more comprehensive understanding of the determinants of government expenditure as a percentage of GDP. The augmented version explains a long-term association between government expenditure with economic growth and deficit variable. Here the share of expenditure in GDP is a function of GDP per capita and the Budget deficit as a share of GDP.

This is estimated in double log form as

L(E/GDP) = a + b L(GDP/P) + c L(BD/GDP) + e, where c<0(Halicioglu, 2003 [10]).

According to Alimi, 2013 [3], adding the budget deficit variable is justified as it does not contradict the presumptions of the law and lowers the misspecification, omitted variables bias in estimations.

Data definition and sources: To conduct this research the sample period considered is from 1981-82 till 2019-20 which gives us 39 annual observations. To measure public spending/government spending or expenditure we use the total government expenditure of the Center which is the sum of revenue and capital expenditure. Gross Domestic Product is used as a measure of economic growth in all models. The third variable is total population (P) which is used to obtain per capita GDP and per capita expenditure estimates. Data on consumption expenditure is the government's final consumption expenditure. All nominal values of expenditure and income have been deflated at 2010 prices (WPI) to get their real values which are then used for estimations. Budget Deficit is proxied by Fiscal deficit. The economic variables used are changed into natural logarithms before estimation. So, the notations used in the paper are as follows

LE- natural log (real expenditure)
LG-natural log (real gross domestic product (GDP)),
L (E/P)-natural log (per capita real expenditure)
L (G/P)-natural log (per capita real GDP)
LC-natural log (real consumption expenditure)
L(E/GDP)-natural log (ratio of real expenditure to real GDP)
L(BD/G)-natural log (ratio of budget deficit to real GDP)

Data on the above variables has been taken from different issues of the Handbook of Statistics, RBI, EPWRF database and World Bank database.

IV. METHODOLOGY AND RESULTS

The approach adopted in this paper involves examining for stationarity, determining whether there is cointegration, constructing the vector error correction model and testing for Granger causality within this framework.

A. Tests for Stationarity

This research makes use of time series data on the variables viz. GDP, total expenditure, consumption expenditure, their per capita values and BD/G. The first step would be to assess the stationarity of the variables. We need to ensure that either the individual time series are stationary, or they are cointegrated. If this does not hold then regression may be spurious. However, if the individual series are non-stationary but are found to be cointegrated, then regression which contains these two series is real and not spurious (Gujarati and Porter, 2010, [8][31][32]). So, in the first step in our methodology, we conduct the stationarity test using the Augmented Dicky Fuller test (both with intercept and intercept plus trend), to check the presence of unit roots in the series.

The forms of the ADF test are given by the following equations:

With drift $\Delta y_t = a_0 + \gamma y_{t-1} + \sum_{i=1}^{p} \beta i \Delta y_{t-1} + e_t$

With drift and linear trend $\Delta y_t = a_0 + \gamma y_{t-1} + a_2 t + \sum_{i=1}^{p} \beta i \Delta y_{t-1} + e_t$

In all cases the null hypothesis is γ=0 which implies that the series contains a unit root and is thus nonstationary. The alternative hypothesis of this test is that the series is stationary.

B. Results -Stationarity Tests

Results of the Augmented Dicky Fuller test on the levels of the variables are given in Table 1. Based on the calculated ADF test statistic, p-value and critical values we conclude that the null hypothesis of non-stationarity in all the given series i.e. LE, LG, L (E/P), L (G/P), L(C), L(BD/G) cannot be rejected. This means all the series contain a unit root. So, now conducting the ADF test on the first differences of the same variables, we tabulate the results in the lower half of Table-I. When we run the ADF test on the first difference of the series we find that based on the ADF test statistic, the null hypothesis of non-stationarity is rejected for all the variables which implies that the differenced series for all the variables is stationary. (Table -I). Hence LE, LG, L (E/P), L (G/P), L(C), L(BD/G), are I (1) i.e. integrated of order one as they have become stationary after the first difference.

Table-I. Results of Augmented Dicky Fuller Tests for Stationarity

Variable	Constant, No trend		Constant, Trend		Result
In Levels	ADF-Test statistic	p-value	ADF-Test-statistic	p-value	
LE	-0.278	0.9184	-2.922	0.167	NST
LG	1.011	0.995	-1.092	0.917	NST
L(E/P)	-0.050	0.947	-1.978	0.592	NST
L(G/P)	1.693	0.995	-0.685	0.967	NST
L(C)	0.155	0.965	-2.789	0.209	NST
L(E/GDP)	-1.547	0.498	-3.645	0.039	NST
L(BD/G)	-1.908	0.324	-3.481	0.055	NST
In First Difference	ADF- Test statistic	p-value	ADF- Test-statistic	p-value	
LE	-4.40	0.001	-4.30	0.008	ST
LG	-4.421	0.001	-4.533	0.004	ST

Retrieval Number:100.1/ijef.A257404010524
DOI:10.54105/ijef.A2574.04010524
Journal Website: www.ijef.latticescipub.com

Published By:
Lattice Science Publication (LSP)

L(E/P)	-4.382	0.001	-4.308	0.008	ST
L(G/P)	-4.250	0.002	-4.541	0.005	ST
L(C)	-4.051	0.003	-4.008	0.017	ST
L(E/GDP)	-4.042	0.003	-4.009	0.017	ST
L(BD/G)	-5.874	0.000	-5.929	0.000	ST

Note: NST-nonstationary, ST-stationary

Test critical values -With constant at 1% level is –3.626, at 5% level is -2.945, at 10%level is -2.611

with constant, trend at 1% is –4.239, at 5% level is -3.536, at 10%level is -3.200

C. Cointegration test

The next step after conducting stationarity tests is as follows. We test for cointegration between the pairs of variables in each version using the Johansen and Juselius,1990,[13] cointegration approach. Before starting with the Johansen methodology, we must estimate the VAR model consisting of the expenditure and economic growth variables using different lag lengths so that we can set the appropriate lag length. Johansen and Juselius,1990,[13] cointegration method uses two likelihood ratio test statistics viz. Trace test statistic and max eigenvalue test statistic to know the number of cointegrating vectors.

Table-II. Results of Johansen Cointegration Tests

Null Hypothesis	Alternative Hypothesis	Test Statistic	95% Critical Value	p-value
Peacock-Wiseman Version				
Max. eigen value test				
R = 0	R = 1	16.107	14.264	0.025
R ≤ 1	R = 2	1.321	3.841	0.250
Trace test				
R = 0	R = 1	17.428	15.494	0.025
R ≤ 1	R = 2	1.321	3.841	0.250
Gupta version				
Max. eigen value test				
R = 0	R = 1	15.014	14.264	0.038
R ≤ 1	R = 2	2.696	3.841	0.100
Trace test				
R = 0	R = 1	17.711	15.494	0.023
R ≤ 1	R = 2	2.696	3.841	0.100
Goffman version				
Max. eigen value test				
R = 0	R = 1	18.448	14.264	0.010
R ≤ 1	R = 2	2.316	3.841	0.128
Trace test				
R = 0	R = 1	20.764	15.494	0.007
R ≤ 1	R = 2	2.316	3.841	0.128
Pryor version				
Max. eigen value test				
R = 0	R = 1	19.018	14.264	0.008
R ≤ 1	R = 2	2.975	3.841	0.084
Trace test				
R = 0	R = 1	21.994	15.494	0.0045
R ≤ 1	R = 2	2.975	3.841	0.0845
Musgrave version				
Max. eigen value test				
R = 0	R = 1	15.01	14.264	0.038
R ≤ 1	R = 2	2.696	3.841	0.100
Trace test				
R = 0	R = 1	17.711	15.494	0.028
R ≤ 1	R = 2	2.696	3.841	0.100
Mann version				
Max. eigen value test				
R = 0	R = 1	16.107	14.264	0.025
R ≤ 1	R = 2	1.321	3.841	0.250
Trace test				
R = 0	R = 1	17.428	15.494	0.025
R ≤ 1	R = 2	1.321	3.841	0.250
Augmented version				
Max. eigen value test				
R = 0	R = 1	24.174	21.131	0.018
R ≤ 1	R = 2	3.482	14.264	0.909
R ≤ 2	R=3	1.665	3.841	0.196
Trace test				
R = 0	R = 1	29.322	29.797	0.056
R ≤ 1	R = 2	5.148	15.494	0.792
R≤ 1	R=3	1.665	3.841	0.196

Note: R is the number of cointegrating relations

Retrieval Number:100.1/ijef.A257404010524
DOI:10.54105/ijef.A2574.04010524
Journal Website: www.ijef.latticescipub.com

Published By:
Lattice Science Publication (LSP)

Indian Journal of Economics and Finance (IJEF)
ISSN: 2582-9378 (Online), Volume-4 Issue-1, May 2024

D. Results-Cointegration Tests

After obtaining the result that the series used in the different models in the study are I (1) we examine for cointegration, using the Johnsen Juselius methodology to test the long-run relation among government spending and economic growth. Using the AIC criterion to select the optimal lag length, we proceed with the optimal lag length of 2 in all versions of wagner law except the Pryor model where the lag length is 3. In the augmented version also lag length is 2. After conducting the cointegration test for all models, the results are given in Table -II. The trace and max eigenvalue statistic results indicate the presence of one cointegrating vector at a 5% level of significance in all 6 versions of Wagner's law. In the case of the augmented version we find that while the trace test does not support cointegration, the eigenvalue test statistic indicates the presence of one cointegrating vector.

E. Vector Error Correction Model and Causality Tests

The existence of cointegration does not specify the direction of causality but implies causality exists in at least one direction. For this, the Granger causality test is conducted within the error correction framework. The VECM is used in testing for long-run and short-run causality among the cointegrated variables. “According to the Granger representation theorem, given any set of I (1) variables, error correction and cointegration are equivalent representations” (Enders,2004[5]). If a cointegrating relation exists between two series, then there is an error correction model which states that the change in the dependent variable is a function of (i) the error correction term which shows the disequilibrium in the cointegrating relationship and (ii) lagged changes in explanatory variables. This basically, is expanding the VAR model to include a one-period lagged error correction term which is obtained from the cointegrating regression. The VECM for cointegrated variables Yt and Xt can be written as

$$\Delta Y_t = \alpha 1 + \alpha_y(y_{t-1} - \beta x_{t-1}) + \sum_{i=1}^{\square} \alpha_{11}(i)\ \Delta X_{t-i} + \sum_{i=1}^{\square} \alpha_{12}(i)\ \ \Delta Y_{t-i} + u_{xt}$$

$$\Delta X_t = \alpha 2 + \alpha_{x\square}(y_{t-1} - \beta x_{t-1}) + \sum_{i=1}^{\square} \alpha_{21(i)}\ \Delta X_{t-i} + \sum_{i=1}^{\square} \alpha_{22}\ (i)\ \Delta Y_{t-i} + u_{yt}$$

Where β is the parameter of the cointegrating vector and all α are parameters. αy and αx are speed of adjustment coefficients, α11 (i), α12 (i)α21 (i)α22(i) are short-run coefficients and u are the residuals

Where Yt =expenditure and Xt =GDP in our models

Granger causality tests are conducted for the cointegrated variables using the VECM representation. There are two different sources through which Xt can cause Yt, either via the lagged changes of x, or via the lagged error correction term (lagged level of x). So, this means that xt does not granger cause yt if all the a11 (i) are 0 and ay=0. Causality in the long run will hold if the coefficient of the error correction term is statistically significant (different from zero). Short run causality will be inferred by the joint F test of the coefficients of the lagged first difference of explanatory variables.

F. Results-VECM

Next, the Vector error correction model is constructed to determine causality between the two variables both in the long-run and short-run in the cointegrated cases. A lag length of 1 is used for the VECM estimation in all cases except the Pryor model where the lag length is 2.

Table-III. Results of the Vector Error Correction Model

Peacock-Wiseman Version

	LE(-1)	**L(G(-1)**	**C**	
COINT EQ.1	1	-0.885 (0.027) {-32.356}	0.654	
	Coint eq	**D(L(G(-1)**	**D(LE(-1)**	**C**
D(LE)	-0.376 (0.106) {-3.544} [0.000]	-0.328 (0.304) {-1.08} [0.284]	0.508 (0.148) {3.425} [0.001]	0/053 (0.020 {2.635} [0.010]
D(L(G)	-0.014 (0.066) {-0.216} [0.829]	0.254 (0.190) {1.33} [0.187]	0.020 (0.093) {0.215} [0.829]	0.049 (0.012) {3.876} [0.000]

Gupta version

	LE/P(-1)	**LG/P(-1)**	**C**	
COINT EQ.1	1	-0.855 (0.038) {-22.25}	1.005	
	Coint eq	**D(L(G/P(-1))**	**D(L(E/P(-1))**	**C**
D(L(E/P)	-0.385 (0.106) {3.600} [0.000]	-0.299 (0.295) {-1.014} [0.314]	0.517 (0.150) {3.433} [0.00]	0.037 (0.015) {2.419} [0.018]
D(L(G/P)	-0.032 (0.068)	0.284 (0.190)	0.018 (0.097)	0.035 (0.009}

Retrieval Number:100.1/ijef.A257404010524
DOI:10.54105/ijef.A2574.04010524
Journal Website: www.ijef.latticescipub.com

Published By:
Lattice Science Publication (LSP)

	{-0.474} [0.636]	{1.492} [0.140]	{0.194} [0.846]	{3.553} [0/000]

Goffman version

	LE(-1)	**L(G/P(-1)**	**C**	
COINT EQ.1	1	-1.183 (0.047) {-24.96}	-1.653	
	Coint eq	**D(L(G/P(-1)**	**D(LE(-1)**	**C**
D(LE)	-0.293 (0.096) {-3.035} [0.003]	-0.251 (0.298) {-0.840} [0.403]	0.428 (0.149) {2.860} [0.005]	0.048 (0.016) {2.974} [0.004]
D(L(G/P)	0.017 (0.060) {0.293} [0.770]	0.331 (0.187) {1.77} [0.081]	-0.003 (0.093) {-0.034} [0.970]	0.033 (0.010) {3.302} [0.001]

Pryor Version

	LC(-1)	**L(G(-1)**			**C**	
COINT EQ.1	1	-0.982 (0.0130) {-72.77}			2.028	
	Coint eq	**D(L(C(-1)**	**D(L(C(-2)**	**D(L(G(-1)**	**D(LG(-2)**	**C**
D(LC)	-0.608 (0.137) {-4.432} [0.000]	0.707 (0.163) {4.331} [0.000]	0.102 (0.182) {0.560} [0.577]	-0.805 (0.294) {-2.732} [0.008]	0.140 (0.304) {0.462} [0.645]	0.058 (0.021) {2.765} [0.007]
D(L(G)	-0.135 (0.100) {-1.344} [0.183]	0.276 (0.119) {2.308} [0.024]	-0.202 (0.134) {-1.508} [0.136]	0.032 (0.216) {0.148} [0.882]	-0.018 (0.223) {-0.084} [0.932]	0.062 (0.015) {3.997} [0.000]

Musgrave Version

	LE/GDP(-1)	**L(G/P(-1)**	**C**	
COINT EQ.1	1	0.144 (0.038) {3.747}	1.005	
	Coint eq	**D(L(G/P(-1)**	**D(LE/GDP(-1)**	**C**
D(LE/GDP)	-0.352 (0.101) {-3.455} [0.001]	-0.085 (0.249) {-0.341} [0.734]	0.499 (0.143) {3.469} [0.000]	0.002 (0.014) {0.139} [0.889]
D(L(G/P)	-0.032 (0.068) {-0.474} [0.636]	0.303 (0.168) {1.796} [0.076]	0.018 (0.097) {0.194} [0.846]	0.035 (0.009) {3.553} [0.000]

Mann Version

	LE/GDP(-1)	**L(G(-1)**	**C**	
COINT EQ.1	1	0.114 (0.027) {4.185}	0.654	
	Coint eq	**D(L(G(-1)**	**D(LE/GDP(-1)**	C
D(LE/GDP)	-0.362 (0.101) {-3.573} [0.000]	-0.095 {0.260} {-0.365} [0.716]	0.488 (0.141) {3.449} [0.001]	0.004 (0.019) {0.215} [0.829]
D(L(G)	-0.014 (0.066) {-0.216} [0.829]	0.274 (0.170) {1.606} [0.113]	0.020 (0.093) {0.215} [0.829]	0.049 (0.012) {3.876} [0.000]

Augmented Version

	LE/GDP(-1)	**L(G/P(-1)**	**L(BD/GDP(-1))**	**C**	
COINT EQ.1	1	-0.275 (0.153) {-1.792}	0.452 (0.153) {2.941}	3.031	
	Coint eq	**D(LE/GDP)-1)**	**D(L(G/P(-1)**	**D(BD/GDP(-1)**	**C**
D(LE/GDP)	-0.173 (0.04928)	0.413 (0.158)	-2.404 (0.272)	0.019 (0.042)	0.008 (0.016)

Published By:
Lattice Science Publication (LSP)

	{-3.520} [0.000]	{2.609} [0.010]	{-0.883} [0.379]	{0.0445} [0.656]	{0.535} [0.593]
D(L(G/P)	-0.002 (0.030) {-0.060) [0.952]	-0.108 (0.099) {-1.093} [0.276]	0.443 (0.170) {2.600} [0.010]	0.064 (0.026) {2.420} [0.017]	0.024 (0.010) {2.368} [0.019]
D(L(BD/GDP))	-0.666 (0.215) {-3.093) [0.002]	1.401 (0.693) {2.021} [0.046]	-1.978 (1.189) {-1.665} [0.099]	-0.180 (0.185) {-0.975} [0.332]	0.170 (0.071 {2.383} [0.019]

Note: The values in brackets are standard errors (round bracket) and t-statistics (curly bracket) and p values (square brackets) respectively

Results of the VECM are presented in Table-III for all the models. In the case of the Goffman and Gupta versions, the estimated coefficient of the economic growth variable i.e. elasticity provides support to the validity of Wagners law. In the case of the Pryor model elasticity is nearly close to 1. In the case of the Peacock, Musgrave and Mann versions as the estimated elasticity does not confirm with expected values, the Wagners law is not valid in these cases. In the augmented version, the results display that the estimated coefficient of growth variable (significant at 10% level) and budget deficit variables are in accordance to the theory. Next, we study the long-run and short-run causality results. Causality in the long run will hold if the coefficient of the cointegrating vector is statistically significant (different from zero). Based on the t-statistic of the lagged error correction terms, we can say that there is the presence of causality which is unidirectional from economic growth to expenditure and not the reverse in all versions of Wagners law. In the augmented model, the error correction term in the expenditure equation is negative and statistically significant which indicates the presence of long-run causality from GDP and budget deficit variables to expenditure. This supports the validity of Wagners law. The direction of short-run causality can be inferred from the significance of the lagged differenced variable. Results of the t-statistic of the lagged explanatory variable, show the absence of any short-run causality in either direction in all versions except the Pryor model. In the Pryor model, causality between economic growth and expenditure in the short run is found to be bidirectional (Table-IV). In the augmented model there is an absence of any short-run causality from the growth or deficit variable to the expenditure variable.

Table-IV Results of Granger Causality Test (Pryor Model)

Null Hypothesis	Chi-sq. Statistic	p-value
DLC does not Granger cause DLG	6.752	0.034
DLG does not Granger cause DLC	7.909	0.019

VECM under all six versions of Wagners law was subject to tests of normality, autocorrelation and heteroskedasticity and found suitable on all counts. The augmented model was found suitable on criteria of autocorrelation and heteroskedasticity but normality may be an issue.

V. CONCLUSION

In this research paper, we tested for the existence of a long-run relation among public expenditures and economic growth in India from 1981-82 till 2019-20 using annual data. Employing augmented Dickey fuller test of stationarity, Johnsen cointegration methodology, VECM framework and Granger causality tests, we tested various versions of Wagner's law and the augmented version. The results for the Indian economy over the sample period 1981-82 to 2019-20 are found to be different across the models. Results show that there exists cointegration among economic growth and expenditure in India in all the Wagner law versions, including the augmented version containing, implying that there is a long-run relationship among the variables. The estimate of elasticity confirms with expected values in Gupta and Goffman models supporting the validity of Wagner's law in India over the sample period. Moreover, our analysis revealed a strong presence of unidirectional causality going from economic growth to expenditure in the long run in these versions, thus supporting Wagners' hypothesis. In the augmented model also, presence of long-run causality from GDP and budget deficit variables to expenditure is obtained. Short-run causality is obtained only in the Pryor version. In the Pryor model, causality between economic growth and expenditure, which is bidirectional in the short run, exists which indicates a feedback relationship among the variables in the short run. Thus, the results of this study show that some versions lend support for the validity of Wagner's law for India over the sample period considered.

DECLARATION STATEMENT

Funding	No. We did not receive any financial support for this article.
Conflicts of interest	No conflicts of interest to the best of our knowledge
Ethical approval and consent to participate	No, the article does not require ethical approval and consent to participate with evidence.
Availability of data and material	Mentioned under data and sources in Section III
Authors contributions	All authors have equal participation in this article.

REFERENCES

1. Afzal, M., & Abbas, Q. (2010). Wagner's law in Pakistan: Another look. Journal of Economics and International Finance, 2(1), 12.
2. Ahuja, D., & Pandit, D. (2020). Public Expenditure and Economic Growth: Evidence from the Developing Countries. FIIB Business Review, 9(3), 228-236. https://doi.org/10.1177/2319714520938901
3. Alimi, S. R. (2013). Testing Augmented Wagner's Law for Nigeria Based on Cointegration and Error-Correction Modelling Techniques. MPRA Paper No. 52319. Online at https://mpra.ub.uni-muenchen.de/52319/
4. Budhedeo, S. H. (2018). Cointegration, Causality, and Wagner's Law: An Econometric Analysis for India. Research Journal of Humanities and Social Sciences, 9(4), 785-792. doi: 10.5958/2321-5828.2018.00132.8 https://doi.org/10.5958/2321-5828.2018.00132.8

5. Enders, W. (2004). Applied Econometric Time Series (2nd ed.). Wiley Series in Probability and Statistics.
6. Gangal, V. L. N., & Gupta, H. (2013). Public Expenditure and Economic Growth: A Case Study of India. Global Journal of Management and Business Studies, 3(2), 191-196. Retrieved from http://www.ripublication.com/gjmbs.htm
7. Goffman, I. J. (1968). On the Empirical Testing of Wagner's Law: A Technical Note. Public Finance, 23, 359–364.
8. Gujarati, D. N., & Porter, D. C. (2010). Essentials of Econometrics (4th ed.). Boston, MA.
9. Gupta, S. (1967). Public Expenditure and Economic Growth: A Time Series Analysis. Public Finance, 22, 423–461.
10. Halicioĝlu, F. (2003). Testing Wagner's law for Turkey, 1960-2000. Review of Middle East Economics and Finance, 1(2), 129-140. https://doi.org/10.2202/1475-3693.1007
11. Iyare, S. O., & Lorde, T. (2004). Co-integration, causality and Wagner's law: tests for selected Caribbean countries. Applied Economics Letters, 11(13), 815-825. https://doi.org/10.1080/1350485042000254881
12. Javed, A., & Khan, W. A. (2021). Wagner's Hypothesis in India: An Empirical Investigation Using Bivariate Framework. Webology, 18(6). http://www.webology.org
13. Johansen, S., & Juselius, K. (1990). Maximum likelihood estimation and inference on cointegration--with applications to the demand for money. Oxford Bulletin of Economics and Statistics, 52(2), 169-210. https://doi.org/10.1111/j.1468-0084.1990.mp52002003.x
14. Kesavahraja, M. (2012). Wagner's Law in Sri Lanka: An Econometric Analysis. International Scholarly Research Network, 2012, Article DI 573826, 9 pages. doi: 10.5402/2012/57382 https://doi.org/10.5402/2012/573826
15. Magazzino, C. (2012). Wagner's Law and Augmented Wagner's Law in EU-27. A Time-Series Analysis on Stationarity, Cointegration and Causality, International Research Journal of Finance and Economics, 89, 205-220.
16. Mann, A. J. (1980). Wagner's Law: An Econometric Test for Mexico, 1925-1976. National Tax Journal, 33, 189–201. https://doi.org/10.1086/NTJ41862301
17. Medhi, K. (2014). An Empirical Investigation of the Causality between Government Expenditure and Economic Growth in India during 1974-2010. IOSR Journal of Humanities and Social Science, 19(7), 53-58. https://doi.org/10.9790/0837-19745358
18. Murthy, N R Vasudeva. (1994). Wagner's Law , Spurious in Mexico or Misspecification: A Reply. Public Finance = Finances publiques, vol. 49(2), pages 295-303.
19. Murthy, N. R. Vasudeva (1993). Further Evidence of Wagner's Law for Mexico: An Application of Cointegration Analysis. Public Finance = Finances publiques, vol. 48(1), 92-96.
20. Musgrave, R.A. (1969), Fiscal Systems, New Haven and London: Yale University Press.
21. Najarzadeh, R., & Khorasani, E. (2019). A Review of Wagner's Law and Income Elasticity of the Government Expenditures in Iran (1985-2018). RAIS Conference Proceedings - The 14th International RAIS Conference on Social Sciences and Humanities. https://doi.org/10.2139/ssrn.3459581
22. Narayan, P. K., Nielsen, I., & Smyth, R. (2008). Panel data, cointegration, causality and Wagner's law: Empirical evidence from Chinese provinces. China Economic Review, 19(2), 297-307. https://doi.org/10.1016/j.chieco.2006.11.004
23. Narayan, S., Rath, B. N., & Narayan, P. K. (2012). Evidence of Wagner's Law from Indian States. Economic Modelling, 29(5), 1548-1557. DOI: 10.1016/j.econmod.2012.05.004 https://doi.org/10.1016/j.econmod.2012.05.004
24. Ogbonna, B. C. (2015). Testing for Wagner's Law on Greek Economy. International Journal of Development and Economic Sustainability, 3(5), 26-35. Available at: https://www.researchgate.net/publication/307882725
25. Peacock, A. T., & Wiseman, J. (1961). The growth of public expenditure in the United Kingdom,Princeton University press.
26. Pryor, F. L. (1969). Public Expenditures in Communist and Capitalist Nations. George Allen & Unwin.
27. Sharma, D. V., & Sundaram, R. (2021) Wagner's Law: An Empirical Analysis with Reference to India. 13th international conference on modern research in management, economics and accounting, 05-07 November 2021, Amsterdam.
28. Sharma, S., & Singh, S. (2019). The Validity of Wagner's Law in India: A Post-liberalization Analysis. South Asian Journal of Social Studies and Economics, 4(2), 1-13. https://doi.org/10.9734/sajsse/2019/v4i230124
29. Srinivasan, P. (2013). Causality between Public Expenditure and Economic Growth: The Indian Case. International Journal of Economics and Management, 7, 335–347. https://doi.org/10.2478/revecp-2020-0020
30. Tesařová, Žaneta (2020). Wagner's law testing in the Visegrád Four countries. Review of Economic Perspectives, 20(4), 409-430. https://doi.org/10.2478/revecp-2020-0020.
31. Modi, A., & Kesarani, V. (2023). Digital Lending Laws in India and Beyond: Scrutinizing the Regulatory Blind Spot. In Indian Journal of Economics and Finance (Vol. 3, Issue 1, pp. 1–7). https://doi.org/10.54105/ijef.a2542.053123
32. D, R., & D, Dr. J. (2019). An Examination on Adequacy of Law in India to Regulate and Monitor Media. In International Journal of Engineering and Advanced Technology (Vol. 8, Issue 6s3, pp. 1493–1496). https://doi.org/10.35940/ijeat.f1265.0986s319
33. Forms of Modern Lawmaking in the System of a Theoretical and Applied Paradigm of Law Knowledge. (2019). In International Journal of Recent Technology and Engineering (Vol. 8, Issue 4S, pp. 78–82). https://doi.org/10.35940/ijrte.d1026.1184s19

AUTHORS PROFILE

Dr. Jasneet Kaur Wadhwa, BA(H) Economics, MA(Economics), Ph.D. She is an associate professor at Sri Guru Tegh Bahadur Khalsa College, University of Delhi in the Department of Economics. She did her PhD in "An Evaluation of Finances of the Indian Union Government since 1981". Her areas of specialization are Mathematical methods in economics, statistical methods in economics, and public finance and policy. She has many national and international publications to her credit. She has authored a book titled" Finances of the Government of India: An Evaluation 1981-2012. She has a teaching experience of twenty-one years at Sri Guru Tegh Bahadur Khalsa College.

Dr. Srividya Subramaniam is an Associate Professor in the Department of Economics at Sri Guru Tegh Bahadur Khalsa College, University of Delhi. She completed her BA(H) in Economics MA(Economics), MPhil, and PhD from the University of Delhi. Her areas of research are public economics, financial economics, and macroeconomics. She has presented papers at national and international conferences. She has published research articles in international journals. She has around twenty three years of experience in teaching undergraduate students at Sri Guru Tegh Bahadur Khalsa College. Among the papers taught are introductory microeconomics, introductory macroeconomics, intermediate microeconomics, and international economics to BA(H)Economics and BA(Prog.) students.