Public Expenditure and Economic Development

Regional Analysis of India

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Using univariate and multivariate time series analysis, like panel unit root test and panel co-integration, and the Toda–Yamamoto causality test, the causal relationship between economic development and public expenditure is examined in 28 states of India at different stages of development from 2003 to 2015. In relatively developed and less developed states, a causal flow exists from real sector growth to increase in public expenditure, in line with Wagner's hypothesis. In least developed states, however, bidirectional causality exists between both capital and revenue expenditure to growth, and from growth to capital and revenue expenditure.

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Research on the association between public expenditure and economic growth dates to the 19th and 20th centuries (Wagner 1883; Keynes 1936; Peacock and Wiseman 1961; Peacock et al 1967; Gupta 1967, 1969; Musgrave 1969; Michas 1975; Rubinson 1977; Landau 1983). There is much empirical research on the positive and adverse impacts of public expenditure on economic growth and of economic growth on public expenditure. Public expenditure is considered a positive determinant of economic growth in Barro (1990) and Baffes et al (1993), whereas the negative impact is evident in Sheehey (1993); Vedder and Gallaway (1998); Fölster and Henrekson (2001); Furceri and Ribeiro (2008); and Romer and Romer (2010). Other aspects, such as how the structure and composition of public expenditure has an impact on the growth of the economy, have also been studied by Dar and AmirKhalkhali (2002), Gregoriou and Ghosh (2009), Maitra and Mukhopadhyay (2012), and Taiwo and Abayomi (2011). These contradictory results, that is, public expenditure affecting economic growth both positively and adversely, motivate this exploration of the issue at the regional level in India.

The possible direction of causality between public expenditure and economic growth is highlighted by two approaches: Wagner's law (1883) and Keynes's law (1936). Wagner's law of "increasing public and state activities" claims that the role of public expenditure is an endogenous variable in the process of economic growth. His hypothesis asserts that economic growth leads to increase in real income, which results in increased demand for infrastructure, health, education, and social security services. The demand for such public utilities is due to industrialisation and urbanisation, and it increases perpetually; to continue to provide these services, the government needs to make huge expenditures. The Keynesian framework holds that public expenditure is an exogenous factor that influences growth, or public expenditure can be used as a policy measure to generate employment, and boost growth and economic activity.

Macroeconomists cite several conventional and new channels through which public expenditure contributes to economic growth. For any economy, public expenditure consists of, majorly, expenditure on infrastructure and social welfare issues. Public spending on infrastructure positively affects growth through private capital formation. The rate of return on building a factory is much greater if the government spends on power generation, transportation, and telecommunications. However, public expenditure on infrastructure may affect growth adversely if the government finances such expansionary expenditures by raising distortionary taxes, which reduce the rate of return of private investment: the crowding-out effect.

To ensure that the growth rate is consistent, private investment must be durable. To make sure that private investment is durable, the government must spend on the maintenance of such public capital and allocate recurring or revenue expenditure for its upkeep (Kalaitzidakis and Kalyvitis 2004; Rioja 2003). On the social welfare front, public capital plays an important role. Public spending on education, health, and welfare issues contributes to economic growth. Higher levels of education create awareness regarding society's health needs. Good health raises life expectancy and, thereby, economic productivity. Thus, the government must consider how spending on infrastructure and social welfare contributes, directly or indirectly, to growth before allocating public expenditure.

Both the suppositions have been subjected to extensive empirical validation, suggesting the interest of economists and policymakers in the subject. Recent research supports Wagner's law for developed nations such as the United States (US) (Islam 2001). Chang (2002) finds support for industrialised nations such as Japan, the US, and the United Kingdom (UK), and for emerging industrialised nations such as South Korea, Taiwan, and Thailand. Lamartina and Zaghini (2011) support Wagner's law for 23 OECD (Organisation for Economic Co-operation and Development) countries, Kumar et al (2012) for New Zealand, Ono (2014) for Japan, and Afonso and Alves (2017) for 14 European countries.

The law is supported by Al-Faris (2002) for the Gulf Cooperation Council countries and by Akitoby et al (2006) for 51 developing countries. Tan (2003) finds support for Malaysia, Sideris (2007) for Greece, Samudram et al (2009) for Malaysia, and Kalam and Aziz (2009) for Bangladesh. However, several studies contradict Wagner's law (Bird 1971; Ram 1986; Abizadeh and Grey 1985; Ahsan et al 1996; Courakis et al 1993; Afxentiou and Serletis 1996; Ansari et al 1997; Abizadeh and Yousefi 1998; Asseery et al 1999; Burney 2002; Huang 2006).

Studies that validate the Keynesian hypothesis of public expenditure are Pradhan (2007) for India, Babatunde (2008) for Nigeria, Magazzino (2010) for Italy, and Ighodaro and Oriakhi (2010) for Nigeria. Studies that support neither the Wagnerian nor the Keynesian view are Singh and Sahni (1984) and Verma and Arora (2010) for India, Bagdigen and Cetintas (2003) for Turkey, and Narayan et al (2008) for the full sample of Chinese provinces. In 10 OECD countries, the demand for public expenditure is low in the early and advanced stages of development; during the development stage, however, demand takes an inverted U-shape (Funashima 2017). These mixed empirical results, and the growing importance and policy implications of public expenditure in a developing country like India make the issue interesting.

This article examines the causal relationship between government expenditure and economic growth in states in India that are in different phases of economic development. In particular, it tries to answer a few questions pertaining to growth theory in macroeconomics: Is there a relationship between government spending and economic growth? Is the relationship bidirectional? If not, is it in line with Wagner's theory or Keynesian theory? Is the nature of this relationship robust over different stages of economic development? Using annual data of several variables pertaining to government spending and economic growth representing 28 states of India and a series of univariate, multivariate, and causality tests, this article provides useful insights into these issues.

In most of the previous studies, the sample used is either a group of countries—14 European nations (Afonso and Alves 2017)—or a single country, such as Japan (Ono 2014). There are also state-specific studies, such as on Nagaland in India (Lhoungu et al 2016). This study is unique as it examines Wagner's or Keynes's law at an inter-region or state-level in India at different development levels using panel data. Previous studies use a data sample of one country or treat a group of countries as a separate sample each time (Henrekson 1993). Exploration of the merits of panel data analysis is limited. This study uses a rich data set, with representation from 28 states in India for a period of 13 years, under different panels based on the development index classification specified in a report by the Ministry of Finance, Government of India (GoI 2013). The unique methodological contribution is the use of the panel unit root, panel co-integration, and panel causality approaches.

Variables and Data

The analysis utilises yearly panel data for 2003–15 for 28 states of India as a full sample panel, classified into panels comprising six relatively developed states in Panel 2, 12 less developed states in Panel 3, and 10 least developed states in Panel 4. The classification is based on the development index by the Ministry of Finance, GoI (Table 1).

The index is developed on 10 subcomponents: monthly per capita expenditure (MPCE), education, health, household amenities, poverty rate, female literacy, percentage of Scheduled Caste (SC) and Scheduled Tribe (ST) population, urbanisation rate, financial inclusion, and connectivity. The report states that if the score of a state is 0.6 and above on the (under)development index, the state is "least developed," states that score below

Table 1: Development Index

State	Development Index	State	Development Index
Andhra Pradesh	0.54	Maharashtra	0.37
Arunachal Pradesh	0.74	Manipur	0.58
Assam	0.71	Meghalaya	0.70
Bihar	0.76	Mizoram	0.52
Chhattisgarh	0.74	Nagaland	0.57
Goa	0.05	Odisha	0.79
Gujarat	0.50	Punjab	0.39
Haryana	0.43	Rajasthan	0.65
Himachal Pradesh	0.42	Sikkim	0.41
Jammu and Kashmir	0.53	Tamil Nadu	0.36
Jharkhand	0.74	Tripura	0.47
Karnataka	0.48	Uttar Pradesh	0.65
Kerala	0.15	Uttarakhand	0.39
Madhya Pradesh	0.76	West Bengal	0.56

Source: Ministry of Finance, Government of India.

0.6 and above 0.4 are "less developed," and states that score below 0.4 are "relatively developed" (Table 2).

Table 2: Classification Based on the Development Index

Relatively Developed	Less Developed	Least Developed
1 Goa	1 Andhra Pradesh	1 Arunachal Pradesh
2 Kerala	2 Gujarat	2 Assam
3 Maharashtra	3 Haryana	3 Bihar
4 Punjab	4 Himachal Pradesh	4 Chhattisgarh
5 Tamil Nadu	5 Jammu and Kashmir	5 Jharkhand
6 Uttarakhand	6 Karnataka	6 Madhya Pradesh
	7 Manipur	7 Meghalaya
	8 Mizoram	8 Odisha
	9 Nagaland	9 Rajasthan
	10 Sikkim	10 Uttar Pradesh
	11 Tripura	
	12 West Bengal	

Source: Based on the development index in Table 1.

Data were collected from the database of the Economic and Political Weekly Research Foundation (EPWRF). The variables used in this study are selected for their suitability as measures of economic growth and public expenditure and are used universally in the literature.

Economic development is measured by annual net state domestic product per capita (NSDPPCA) at constant prices for each state. It is determined by

$$\text{NSDPPCA} = \frac{\text{NSDP (at constant prices)}}{\text{Population}} \qquad \dots (1)$$

Three indicators of public expenditure are used: public expenditure as ratio of net state domestic product (PUBEXSDP), aggregate capital expenditure (CAPEX), and revenue expenditure (REVEX).

PUBEXSDP is used as a measure of aggregate public expenditure in relation to state domestic product. It implies the size of expenditure devoted towards collective social wants of the population, divided mainly between developmental (growth-enhancing) activities and non-development activities.

Aggregate CAPEX is used as a measure of non-recurring public expenditure on the social sector (education, health, family welfare, housing, and urban development) and of economic expenditure (on energy, transport, industry, and infrastructure). Such expenditures aid in improving a region's productive capacity.

REVEX is the routine consumption expenditure incurred on developmental, non-developmental, and general economic services.

Methodology

To identify the development stage that a state belongs to, this article refers to the most recent classification made in the report of the committee for evolving a composite development index of states (GoI 2013). To check for a linear association between public expenditure and economic development, the univariate analysis approach is employed as a preliminary (Table 3). The data of each state are sorted in descending order of NSDPPCA and divided into five quintiles—q1, q2, q3, q4, and q5 (q1 is the quintile with the highest NSDPPCA and q5 the lowest). The mean of the public expenditure variables is found for each quintile. An increasing (decreasing) trend in the public expenditure variables across quintiles would indicate a positive (negative) association with NSDPPCA, and give a preliminary indication of an association between public expenditure and economic development. This exercise is conducted separately for the full sample (all 28 states), six relatively developed states, 12 less developed states, and 10 least developed states.

Table 3: Univariate Analysis

Variables		q1	q2	q3	q4	q5
Panel-1: All States (Full Sample)						
NSDPPCA	FS	68128.103	39096.454	28653.671	22190.198	14843.778
PUBEXSDP	FS	0.4824012	0.7323642	0.5587325	0.5539132	0.3250935
CAPEX	FS	61527.032	79637.268	35802.695	29669.724	10524.139
REVEX	FS	26909.884	21826.519	12555.775	9562.1022	3753.5157
Panel-2: Relatively developed states						
NSDPPCA	FS	85554.192	55506.068	43252.771	32650.013	24708.396
PUBEXSDP	FS	0.3977077	0.4351816	0.3229257	0.2086029	0.1809911
CAPEX	FS	75933.547	61951.495	36435.71	15314.994	7719.843
REVEX	FS	28029.788	19798.581	11922.223	5421.3953	3713.9936
Panel-3: Less developed states						
NSDPPCA	FS	54298.664	37805.154	29885.299	24191.659	18927.906
PUBEXSDP	FS	0.7035616	0.7080985	0.6175472	0.6312068	0.4798841
CAPEX	FS	85395.772	70183.998	33940.121	19735.213	15296.798
REVEX	FS	33978.264	21349.337	14520.276	11715.765	6839.7608
Panel-4: Least developed states						
NSDPPCA	FS	31190.591	23845.79	19657.293	16120.195	11698.731
PUBEXSDP	FS	1.2778134	0.6222693	0.4025622	0.3314898	0.3147005
CAPEX	FS	137783.8	49818.165	29669.412	8986.8335	9122.3861
REVEX	FS	31789.249	11887.846	6182.3381	4187.2471	2858.0716

This table reports the means of the univariate analysis conducted on panels of all states, relatively developed states, less developed states, and least developed states. Each of the panels comprises one sub-panel, full sample. The respective sample length is sorted from largest to smallest and divided into five quintiles—q1, q2, q3, q4, and q5—and their respective average (mean) derived. The analysis gives us an initial idea about the probable existence of association between variables pertaining to economic development (NSDPPCA) and public expenditure (PUBEXSDP, CAPEX, and REVEX). It is observed from the table that at several panels the variables display the above-mentioned linear relationship, giving us evidence to study further.

In this study, most of the analysis is on panel or pooled data. To avoid problems of limited size and power properties of the conventional Augmented Dickey–Fuller (ADF) test under the panel scenario (Breitung 2001; Hlouskova and Wagner 2006), panel unit root tests (Levin et al 2002; Im et al 2003) are employed. The Levin et al (2002) test is designed on the principles of the ADF test, but it allows for heterogeneity of the intercepts across panel members. The model allows for fixed effects, unit-specific time trends, and common time effects. The coefficient θ_L of lagged dependent variable is restricted to be homogeneous across all units of the panel. First, the ADF for each cross-section is estimated:

$$\Delta y_{it} = \rho_i y_{i,t-1} + \sum_{L=1}^{p_i} \theta_{iL}\, \Delta y_{i,t-L} + \alpha_{mi} d_{mt} + \varepsilon_{it} \qquad \dots (2)$$

where, $i = 1, 2........, N$ represents the states in the panel, $t = 1, 2........, T$ represents the year in the panel, $m = 1, 2, 3$ indexes of the case considered, y_{it} is the series for states i in the year t, and p_i is the number of lags required for conducting ADF regression. Then, two regressions are run in order to obtain the residual $\hat{e}_{it}$ and $\hat{v}_{it-1}$

(1) Δy_{it} on $\Delta y_{i,t-L}$ and d_{mt} to get the residual $\hat{e}_{it}$ and
(2) $y_{i,t-1}$ on $y_{i,t-L}$ and d_{mt} to obtain residuals $\hat{v}_{it-1}$

Standardisation of the residuals is done through $\tilde{e}_{it} = \hat{e}_{it}/\hat{\sigma}_{\varepsilon_i}$; $\tilde{v}_{it-1} = \hat{v}_{it}/\hat{\sigma}_{\varepsilon_i}$. Finally, a pooled ordinary least square regression is done through the following equation

$$\tilde{e}_{it} = \rho\tilde{v}_{it-1} + \tilde{\varepsilon}_{it}$$

Thus, the null hypothesis is $\rho = 0$ and a non-stationary panel. A non-zero ρ implies rejection of the null.

The null hypothesis of the Levin et al (2002) test is that all cross-sections have a unit root. This is too restrictive. The Im et al (2004) test allows individual unit root processes to vary across cross-sections; therefore, it is conducted, too. The results are in line with those of the Levin et al (2002) test (these results are not reported here, for the sake of brevity, but are available on request).

The results of the panel unit root tests show that all variable series considered for analysis are I(1), or integrated of order 1, with no intercept and no trend (Table 4). On testing the unit root with individual intercept and deterministic trend, however, the order of integration reflects that the variables under study are integrated of different order: they are either I(0) or I(1) (Table 4). Typically, this serves as a suitable prerequisite for the panel co-integration test, and it negates the possibility of carrying out standard pairwise Granger causality tests, as it leads to bias and spurious regression.

Panel co-integration tests are conducted to explore the long-term equilibrium relation between the chosen variables under study. The advanced Toda–Yamamoto causality test is adopted under the condition of non-stationarity. A co-integration test is used to check the presence of a long-run equilibrium relationship among variables. Typically, the lack of co-integration suggests that there is no association among the variables under study, and that these may drift away from each other in the long run. Using Kao (1999) and the Pedroni (2004) panel co-integration test, the variables are tested for a possible long-run equilibrium relationship. Pedroni (1999, 2004) provides seven different residual-based panel co-integration tests for testing the null hypothesis of no co-integration ($Ho: \rho i = 1,$ for all $i = 1, N$). However, the alternative hypothesis for four within-dimension-based statistics (Panel v, Panel rho, Panel PP, Panel ADF) is $H1: \rho i = \rho < 1,$ for all $i=1, \ldots, N$. For three between-dimension-based statistics (Group rho, Group PP, Group ADF), it is $H1: \rho i < 1$, for all $i=1, \ldots, N$. Kao (1999) provides the parametric residual-based panel co-integration for the null hypothesis of no co-integration.

The exact nature of the relation in terms of direction of causal flows is ascertained. All series under consideration are found to be a mix of I(0) and I(1) with intercept and deterministic trend. The Toda–Yamamoto (1995) test is employed to test the causal flow between public expenditure and economic development. The lag length is selected based on the Akaike Information Criterion (AIC) and Schwarz Information Criterion (SIC) (Table 6, p 54).

Toda and Yamamoto (1995) propose an alternative causality test that can be applied "whether the VARs may be stationary (around a deterministic trend), integrated of an arbitrary order, or cointegrated of an arbitrary order." The testing procedure is similar to Granger causality, but it is augmented with extra lags, depending on the maximum order of integration of the series under consideration. In this approach, if in a pairwise causality test one or both the series are non-stationary, a vector-autoregressive model (VAR) is constructed in their levels with a total of $(k+d_{max})$ lags, where k is the optimal number of lagged terms included, which is determined by the AIC/SIC. If $k = 1$ and if two series y_t and x_t have different orders of integration—respectively, I(0) and I(1)—so that $d_{max} = 1$, one extra lag is added to each variable. Thus, a VAR with two lags (based on AIC and SIC) is constructed:

$$\begin{bmatrix} y_t \\ x_t \end{bmatrix} = \begin{bmatrix} \beta_{10} \\ \beta_{20} \end{bmatrix} + \begin{bmatrix} \beta_{11}^{(1)} & \beta_{12}^{(1)} \\ \beta_{21}^{(1)} & \beta_{22}^{(1)} \end{bmatrix} \begin{bmatrix} y_{t-1} \\ x_{t-1} \end{bmatrix} + \begin{bmatrix} \beta_{11}^{(2)} & \beta_{12}^{(2)} \\ \beta_{21}^{(2)} & \beta_{22}^{(2)} \end{bmatrix} \begin{bmatrix} y_{t-1} \\ x_{t-1} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \end{bmatrix} \quad \ldots (3)$$

A Wald test (also called the modified Wald or MWALD) is carried out to determine the relationship between two variables. The Wald statistic follows asymptotic $\chi 2$ distribution. It can be applied even if y_t and x_t are I(0), I(1), or I(2), non-cointegrated, and/or the stability and rank conditions are not satisfied, provided "the order of integration of the process does not exceed the true lag length of the model" (Toda and Yamamoto 1995).

Results

Table 3 shows the results of the univariate analysis. It provides an initial idea of the probable existence of association between variables pertaining to economic development and public

Table 4: Results of the Panel Unit Root Test

Variables	All States			Relatively Developed States			Less Developed States			Least Developed States		
	LLC–Stat			LLC–Stat			LLC–Stat			LLC–Stat		
	LE	FD	Inference	LE	FD	Inference	LE	FD	Inference	LE	FD	Inference
With no individual intercept and no trend												
NSDPPCA	8.65	-5.36*	I(1)	5.42	-9.23*	I(1)	9.9	-12.56*	I(1)	9.14	-13.89*	I(1)
PUBEXSDP	14.69	-16.82*	I(1)	7.78	-7.90*	I(1)	9.36	-12.39*	I(1)	8.79	-6.68*	I(1)
CAPEX	4.99	-9.18*	I(1)	1.24	-4.18*	I(1)	3.52	-4.75*	I(1)	3.12	-5.89*	I(1)
REVEX	16.39	-7.91*	I(1)	10.09	-3.82*	I(1)	9.44	-5.08*	I(1)	8.9	-3.62*	I(1)
With individual intercept and trend												
NSDPPCA	-28.99		I(0)	-24.32		I(0)	-15.89		I(0)	-15.89		I(0)
PUBEXSDP	-2.48		I(0)	-0.4	-37.32	I(1)	-6.03		I(0)	-6.03		I(0)
CAPEX	3.00	-53.82	I(1)	2.76	-41.34	I(1)	1.19	-34.55	I(1)	1.19	-34.55	I(1)
REVEX	-9.23		I(0)	-6.92		I(0)	-6.11		I(0)	-6.11		I(0)

*, **, and *** indicate statistical significance at 1%, 5%, and 10%. I(0) integrated at level, I(1) integrated at order 1. LE: indicates level data; FD: indicates first difference data. The table reports the results of the Levin et al (2002) panel unit root test for the panels of all states, relatively developed states, less developed states, and least developed states. The Im et al (2003) test is conducted for panel unit root. For the sake of brevity, the results are not reported here (these are avaible on request), but the results are almost similar to that of the Levin et al (2002) test.

expenditure. Strong evidence is found of a direct association between economic growth (NSDPPCA) and the two public expenditure variables, aggregate CAPEX and REVEX. The association of NSDPPCA with PUBEXSDP is unclear in the full sample of all states and in the panel representing relatively developed states. In the panels representing less developed and least developed states, however, PUBEXSDP demonstrates a strong linear relationship with NSDPPCA, the proxy for economic development. This observation clearly confirms the possible association between economic development and public expenditure in relatively less developed states and provides evidence for further study.

Table 4 (p 53) presents the results of the panel unit root tests; Table 5 presents the results of the panel co-integration tests. The panel unit root test results show that the variables used in the study are integrated at level (stationary) and of order one for the sample comprising all states. Stationarity tests are conducted for the sub-panels of relatively developed states, less developed states, and least developed states. The results are similar to those of stationarity tests for the full sample of all states. This leads to an examination of the co-integration among them. The panel co-integration test results provide ample evidence of a long-run relationship between the variables (Table 5).

Table 7 shows the results of the Toda–Yamamoto causality test among variables pertaining to economic development (NSDPPCA) and public expenditure variables like PUBEXSDP, aggregate CAPEX, and REVEX. The analysis is conducted on the panels of all states, relatively developed states, less developed states, and least developed states.

For the full sample and for the relatively developed states, causality seems to be unidirectional, from real sector development to public expenditure, in line with Wagner's hypothesis. This is evident from the significant F-statistics figure of 3.05 for full sample and 3.31 for relatively developed states. However, when studied at the disaggregated level of public expenditure, Wagner's hypothesis is observed to be operating for revenue expenditure and not for capital expenditure.

This implies that since relatively developed states have already witnessed adequate progress, the government is not utilising public expenditure as a policy variable for economic growth. The rationale emerges from the fact that as population and urbanisation rise in the process of economic development of each state, revenue expenditure—expenditure on education, health, and social welfare—increases in relatively developed states.

In these states, advancement in trade and industry resulting from economic growth is telling of the growing role of the private sector, which eventually demands more public expenditure. For the less developed sample, there is unidirectional causality flowing from real sector growth to increase in public expenditure, with significant F-statistics of 3.06. This implies that public expenditure is not acting as an exogenous variable influencing economic growth, and that the governments of these states can reduce public expenditure when they desire to take austerity measures.

For the least developed states, there is bidirectional causality between capital as well as revenue expenditure and growth. The null hypothesis of no causality is rejected based on the significant F-statistics of 4.37 and 3.42 (CAPEX–NSDPPCA); 2.50 and 4.47 (REVEX–NSDPPCA). The study reveals that capital expenditure is an endogenous variable. Least developed states require capital expenditure mostly for infrastructure development, which is necessary for economic growth; the governments of these states can manipulate capital expenditure for economic growth. Least developed states cannot ignore social welfare activities; they can raise income by increasing revenue expenditure.

Thus, the study reveals that the Keynesian hypothesis operates for revenue expenditure. The results indicate stronger support for Wagner's law, which postulates that growth in the real sector in a developing economy like India propels the government to spend on utilities demanded by the public. However, on studying the economy by region, the observation for relatively developed

Table 5: Panel Cointegration Test

Pedroni Test Statistics	All States	Relatively Developed States	Less Developed States	Least Developed States
Panel v-statistic	10.69*	7.01*	4.02**	9.07*
Panel rho-statistic	2.61	1.25	1.19	1.38
Panel PP-statistic	-5.97*	-1.69**	-5.03**	-6.80*
Panel ADF-statistic	-1.28**	-0.97	-0.94	-0.88
Group rho-statistic	5.31	2.32	2.98	2.92
Group PP-statistic	-9.18**	-0.59	-4.04**	-11.69*
Group ADF-statistic	-1.29*	0.22	-0.24	-2.37*
Kao ADF Test				
t-stat	0.67	-3.43	-1.18	1.92
Prob	0.24	0.00	0.10	0.00

*,** indicates statistical significance at 1% and 5%.
The table reports the results of Pedroni panel cointegration tests (1999, 2004) and Kao ADF test (1999) for the panels of all states, relatively developed states, less developed states, and least developed states.
Null hypothesis is no cointegration.
Pedroni assumes a deterministic intercept and trend. Pedroni ADF has an automatic lag length selection using SIC. Newey–West automatic bandwidth selection and Bartlett kernel are used.
Kao assumes an individual intercept and no deterministic trend. Kao's ADF has an automatic lag length selection using SIC.

Table 6: Lag Length Criterion

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-3805.64	NA	4.12e+24	68.02930	68.12639	68.06869
1	-3336.85	895.7268*	1.27e+21	59.94373*	60.42918*	60.14069*
2	-3313.35	43.21899	1.11e+21*	59.80984	60.68365	60.16437
3	-3247.89	115.7327	4.61e+20	58.92654	60.18870	59.43864
4	-3213.37	58.55196	3.33e+20	58.59592	60.24644	59.26559
5	-3185.07	45.99561	2.69e+20	58.37619	60.41506	59.20342
6	-3180.51	7.073479	3.35e+20	58.58060	61.00783	59.56540

*Indicates the optimal lag length.

Table 7: Panel Causality Test

	All States		Relatively Developed States		Less Developed States		Least Developed States	
Causality	*F-Stat*	*Prob*	*F-Stat*	*Prob*	*F-Stat*	*Prob*	*F-Stat*	*Prob*
PUBEXSDP to NSDPPCA	0.17	0.84	1.29	0.28	1.39	0.25	2.03	0.13
NSDPPCA to PUBEXSDP	3.05**	0.04	3.31**	0.04	3.06*	0.04	1.31	0.27
CAPEX to NSDPPCA	0.37	0.68	1.29	0.27	0.01	0.98	4.37*	0.01
NSDPPCA to CAPEX	0.34	0.70	0.69	0.50	3.14**	0.04	3.42**	0.03
REVEX to NSDPPCA	2.04	0.13	0.93	0.39	1.93	0.14	2.50***	0.08
NSDPPCA to REVEX	3.55**	0.02	2.96**	0.05	0.89	0.40	4.47*	0.01

*, **, *** denotes significance at, respectively, 1%, 5%, and 10%.

and less developed states remains consistent with the full sample results, but for least developed states, it is seen that public expenditure leads to growth and vice versa.

Conclusions

The causal relationship between economic growth and public expenditure has been debated since the late 19th century, but whether the association between economic development and public expenditure remains stable during the different stages of regional development in an economy has not been conclusively answered.

The primary results for relatively developed and less developed states in India suggest a causal flow from real sector growth to increase in public expenditure, in line with Wagner's hypothesis. This implies that with a steady increase in the real income in Indian states (majorly, relatively developed and less developed states), the demand for basic infrastructure has increased manifold, which stimulates an increase in public expenditure. In less developed states, where the role of capital expenditure is more evident, the observed increase in public expenditure is the result of increase in revenue expenditure, which has a non-developmental effect, and not capital expenditure, which has a developmental impact. In least developed states, capital and revenue expenditure contribute to growth, and growth contributes to capital and revenue expenditure These findings can effectively guide major economic policies.

REFERENCES

Abizadeh, S and J Gray (1985): "Wagner's Law: A Pooled Time-series, Cross-section Comparison," *National Tax Journal*, Vol 38, No 2, pp 209–18.

Abizadeh, S and M Yousefi (1998): "An Empirical Analysis of South Korea's Economic Development and Public Expenditures Growth," *The Journal of Socio-Economics*, Vol 27, No 6, pp 687–700.

Afonso, A and J Alves (2017): "Reconsidering Wagner's Law: Evidence from the Functions of the Government," *Applied Economics Letters,* Vol 24, No 5, pp 346–50.

Afxentiou, P C and A Serletis (1996): "Government Expenditures in the European Union: Do They Converge or Follow Wagner's Law?" *International Economic Journal*, Vol 10, No 3, pp 33–47.

Ahsan, S M, A C Kwan and B S Sahni (1996): "Cointegration and Wagner's Hypothesis: Time Series Evidence for Canada," *Applied Economics*, Vol 28, No 8, pp 1055–58.

Akitoby, B et al (2006): "Public Spending, Voracity, and Wagner's Law in Developing Countries," *European Journal of Political Economy*, Vol 22, No 4, pp 908–24.

Al-Faris, A F (2002): "Public Expenditure and Economic Growth in the Gulf Cooperation Council Countries," *Applied Economics*, Vol 34, No 9, pp 1187–93.

Ansari, M I, D V Gordon and C Akuamoah (1997): "Keynes Versus Wagner: Public Expenditure and National Income for Three African Countries," *Applied Economics*, Vol 29, No 4, pp 543–50.

Asseery, A A, D Law and N Perdikis (1999): "Wagner's Law and Public Expenditure in Iraq: A Test Using Disaggregated Data," *Applied Economics Letters*, Vol 6, No 1, pp 39–44.

Babatunde, M A (2008): "Establishing Wagner's Law in the West Africa Monetary Zone (WAMZ) Investigation Using the Bounds Test," *The Indian Economic Journal*, Vol 56, No 3, pp 109–23.

Baffes, J, A Shah, and B Mundial (1993): "Productivity of Public Spending, Sectoral Allocation Choices, and Economic Growth," Policy Research Working Paper Series, Vol 1178, Public Economic Division, Policy Research Department, World Bank.

Bagdigen, M and H Cetintas (2003): "Causality Between Public Expenditure and Economic Growth: The Turkish Case," *Journal of Economic and Social Research*, Vol 6, No 1, pp 53–72.

Barro, R J (1990): "Government Spending in a Simple Model of Endogenous Growth," *Journal of Political Economy*, Vol 98, No 5, Part 2, pp S103–25.

Bird, R M (1971): "Wagner's Law of Expanding State Activity," *Public Finance = Finances publiques*, Vol 26, No 1, pp 1–26.

Breitung, J (2001): "The Local Power of Some Unit Root Tests for Panel Data," *Nonstationary Panels, Panel Cointegration, and Dynamic Panels* (*Advances in Econometrics, Volume 15*), B Baltagi (ed), Emerald Group Publishing, pp 161–78.

Burney, N A (2002): "Wagner's Hypothesis: Evidence from Kuwait Using Cointegration Tests," *Applied Economics*, Vol 34, No 1, pp 49–57.

Chang, T (2002): "An Econometric Test of Wagner's Law for Six Countries Based on Cointegration and Error-Correction Modelling Techniques," *Applied Economics*, Vol 34, No 9, pp 1157–69.

Courakis, A S, F Moura-Roque and G Tridimas (1993): "Public Expenditure Growth in Greece and Portugal: Wagner's Law and Beyond," *Applied Economics*, 25(1), 125–34.

Dar, A A and S AmirKhalkhali (2002): "Government Size, Factor Accumulation and Economic Growth: Evidence from OECD Countries," *Journal of Policy Modeling*, Vol 24, No 7, pp 679–92.

Fölster, S and M Henrekson (2001): "Growth Effects of Government Expenditure and Taxation in Rich Countries," *European Economic Review*, Vol 45, No 8, pp 1501–20.

Funashima, Y (2017): "Wagner's Law versus Displacement Effect," *Applied Economics*, Vol 49, No 7, pp 619–34.

Furceri, D and M P Ribeiro (2008): "Government Spending Volatility and the Size of Nations," Working Paper Series, No 924, European Central Bank.

GoI (2013): *Report of the Committee for Evolving a Composite Development Index of States*, Ministry of Finance, Government of India, New Delhi.

Gregoriou, A and S Ghosh (2009): "The Impact of Government Expenditure on Growth: Empirical Evidence from a Heterogeneous Panel," *Bulletin of Economic Research*, 61(1), pp 95–102.

Gupta, S P (1967): "Public Expenditure and Economic Growth a Time-series Analysis," *Public Finance Analysis*, Vol 22, No 4, pp 423–54.

— (1969): "Public Expenditure and Economic Development—A Cross-section Analysis," *Finanzarchiv/Public Finance Analysis*, Vol 27, No H 1, pp 26–41.

Henrekson, M (1993): "Wagner's Law—A Spurious Relationship," *Public Finance*, Vol 48, No 2, pp 406–15.

Hlouskova, J and M Wagner (2006): "The Performance of Panel Unit Root and Stationarity Tests: Results from a Large Scale Simulation Study," *Econometric Reviews*, Vol 25, No 1, pp 85–116.

Huang, C (2006): "Government Expenditures in China and Taiwan: Do They Follow Wagner's Law?" *Journal of Economic Development*, Vol 31, No 2, p 139.

Ighodaro, C A and D E Oriakhi (2010): "Does the Relationship between Government Expenditure and Economic Growth Follow Wagner's Law in Nigeria," *Annals of University of Petrosani Economics*, Vol 10, No 2, pp 185–98.

Im, K S, M H Pesaran and Y Shin (2003): "Testing for Unit Roots in Heterogeneous Panels," *Journal of Econometrics*, Vol 115, No 1, pp 53–74.

Islam, A M (2001): "Wagner's Law Revisited: Cointegration and Exogeneity Tests for the USA," *Applied Economics Letters*, Vol 8, No 8, pp 509–15.

Kalaitzidakis, P and S Kalyvitis (2004): "On the Macroeconomic Implications of Maintenance in Public Capital, *Journal of Public Economics*, Vol 88(3–4), pp 695–712.

Kalam, M A and N Aziz (2009): "Growth of Government Expenditure in Bangladesh: An Empirical Enquiry into the Validity of Wagner's Law," *Global Economy Journal*, Vol 9, No 2, pp 1–20.

Kao, C (1999): "Spurious Regression and Residual-Based Tests for Cointegration in Panel Data," *Journal of Econometrics*, Vol 90, No 1, pp 1–44.

Keynes, J M (1936): *General Theory of Employment, Interest and Money*, London: Macmillan.

Kumar, S, D J Webber and S Fargher (2012): "Wagner's Law Revisited: Cointegration and Causality Tests for New Zealand," *Applied Economics*, Vol 44, No 5, pp 607–16.

Lamartina, S and A Zaghini (2011): "Increasing Public Expenditure: Wagner's Law in OECD Countries," *German Economic Review*, Vol 12, No 2, pp 149–64.

Landau, D (1983): "Government Expenditure and Economic Growth: A Cross-country Study," *Southern Economic Journal*, Vol 49, No 3, pp 783–92.

Levin, A, C F Lin and C Chu (2002): "Unit Root Tests in Panel Data: Asymptotic and Finite Sample Properties," *Journal of Econometrics*, Vol 108, No 1, pp 1–24.

Lhoungu, V, B Mishra and P S Suresh (2016): "Public Expenditure and Economic Growth in Nagaland: A Time Series Analysis," *International Journal of Research in Social Sciences*, Vol 6, No 10, pp 839–88.

Magazzino, C (2010): "'Wagner's Law'" Italy: Empirical Evidence "from 1960 to 2008," *G&LER*, Vol 14, No 1, pp 91–115.

Maitra, B and C K Mukhopadhyay (2012): "Public Spending on Education, Health Care and Economic Growth in Selected Countries of Asia and the Pacific," *Health Care and Economic*

Growth in Selected Countries of Asia and the Pacific.

Michas, N A (1975): "Wagner's Law of Public Expenditures: What Is the Appropriate Measurement for a Valid Test?" *Public Finance = Finances Publiques*, Vol 30, No 1, pp 77–85.

Musgrave, R A (1969): *Fiscal Systems*, London: Yale University Press.

Narayan, P K, I Nielsen and R Smyth (2008): "Panel Data, Cointegration, Causality and Wagner's Law: Empirical Evidence from Chinese Provinces," *China Economic Review*, Vol 19, No 2, pp 297–307.

Ono, H (2014): "The Government Expenditure–Economic Growth Relation in Japan: An Analysis by Using the ADL Test for Threshold Cointegration," *Applied Economics*, Vol 46, No 28, pp 3523–31.

Peacock, A T and J Wiseman (1961): *The Growth of Public Expenditure in the United Kingdom*, Cambridge: US National Bureau of Economic Research and Princeton: Princeton University Press.

Peacock, A T, J Wiseman and J Veverka (1967): "The Growth of Public Expenditure in the United Kingdom (No 72)," Allen & Unwin.

Pedroni, P (1999): "Critical Values for Cointegration Tests in Heterogeneous Panels with Multiple Regressors," *Oxford Bulletin of Economics and Statistics*, Vol 61, No S1, pp 653–70.

— (2004): "Panel Cointegration: Asymptotic and Finite Sample Properties of Pooled Time Series Tests with an Application to the PPP Hypothesis," *Econometric Theory*, Vol 20, No 3, pp 597–625.

Pradhan, R P (2007): "Wagner's Law: Is It Valid in India?" *The IUP Journal of Public Finance*, Vol 5, No 2, pp 7–20.

Ram, R (1986): "Causality Between Income and Government Expenditure: A Broad International Perspective," *Public Finance = Finances publiques*, Vol 41, No 3, pp 393–414.

Rioja, F K (2003): "Filling Potholes: Macroeconomic Effects of Maintenance versus New Investments in Public Infrastructure," *Journal of Public Economics*, Vol 87 (9–10), pp 2281–2304.

Romer, C and D H Romer (2010): "The Macroeconomic Effects of Tax Changes: Estimates Based on a New Measure of Fiscal Shocks," *American Economic Review*, Vol 100, No 3, pp 763–801.

Rubinson, R (1977): "Dependence, Government Revenue, and Economic Growth, 1955–1970," *Studies in Comparative International Development*, Vol 12, No 2, pp 3–28.

Samudram, M, M Nair and S Vaithilingam (2009): "Keynes and Wagner on Government Expenditures and Economic Development: The Case of a Developing Economy," *Empirical Economics*, Vol 36, No 3, pp 697–712.

Sheehey, E J (1993): "The Effect of Government Size on Economic Growth," *Eastern Economic Journal*, Vol 19, No 3, pp 321–28.

Sideris, D (2007): "Wagner's Law in 19th Century Greece: A Cointegration and Causality Analysis," Bank of Greece, Working Paper No 64.

Singh, B and B S Sahni (1984): "Causality between Public Expenditure and National Income," *The Review of Economics and Statistics*, Vol 66, No 4, pp 630–44.

Taiwo, M and T Abayomi (2011): "Government Expenditure and Economic Development: Empirical Evidence from Nigeria," *European Journal of Business and Management*, Vol 3, No 9, pp 18–28.

Tan, E C (2003): "Does Wagner's Law or the Keynesian Paradigm Hold in the Case of Malaysia?" *Thammasat Review*, Vol 8, No 1, pp 62–75.

Toda, H Y and T Yamamoto (1995): "Statistical Inference in Vector Autoregressions with Possibly Integrated Processes," *Journal of Econometrics*, Vol 66, No 1, pp 225–50.

Vedder, R K and L E Gallaway (1998): "Government Size and Economic Growth," *Joint Economic Committee*.

Verma, S and R Arora (2010): "Does the Indian Economy Support Wagner's Law? An Econometric Analysis," *Eurasian Journal of Business and Economics*, Vol 3, No 5, pp 77–91.

Wagner, A (1883): "Three Extracts on Public Finance," translated and reprinted in RA.