

# Causality between Public Expenditure and Economic Growth: The Indian Case

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## ABSTRACT

This study investigates the causal nexus between public expenditure and economic growth in India using cointegration approach and error correction model. The analysis was carried out over the period 1973 to 2012. The Cointegration test result confirms the existence of long-run equilibrium relationship between public expenditure and economic growth in India. The empirical results based on the error-correction model estimate indicates one-way causality runs from economic growth to public expenditure in the short-run and long-run, supporting the Wagner's law of public expenditure.

**Keywords:** Cointegration, causality, impulse response function, public expenditure, economic growth

**JEL Classification:** C32, E62, H50

## INTRODUCTION

The relationship between public expenditure and national income has been an enduring issue in economics and public finance literatures both at theoretical and empirical levels. The focus has been mainly on two approaches, first, Wagner's law approach (Keynes, 1883), which states that national income causes public expenditure and second, Keynesian approach (Keynes, 1936), which states that public expenditure causes national income.

Wagner formulated his famous law in which he observed, on the basis of historical evidence for several industrialized countries, that there is a long run tendency for government expenditure to raise as per capita income increases. This observation led to the so called Wagner's law of increasing state activities. Thus, according to this law increased government activity and corresponding

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increase in government expenditure is an inevitable result of economic growth. Wagner (1883) emphasized economic growth as the fundamental determinant of public sector growth. However, Keynes (1936) stated that public expenditure as a fundamental determinant of economic growth. Keynesian theory expressed that the government expenditure, as a fiscal policy instrument, is useful for achieving short-term stability and higher long run growth rate. Therefore, his theory prescribes for government interventions in the economy through the fiscal policies as this plays a crucial role in the development process. According to Keynes, government could alter economic downturns by borrowing money from the private sector and then returning the money to the private sector through various spending programs. Keynesian approach pointed out that public expenditure is an exogenous factor and a policy instrument for mounting national income. Therefore, it posits that the causal relationship between public expenditure and national income runs from expenditure to income.

## **REVIEW OF LITERATURE**

As a consequence of above theoretical debate, there exists an extensive empirical literature with the objective of testing the validity of Wagner's or Keynesian law of public expenditure. The debate about the relationship between size of government expenditure and economic growth has been one that seems ambiguous. Some empirical studies support the Wagner's law rather than the Keynesian stance while other studies endorse the Keynesian hypothesis. Singh and Sahni (1984) examined the causal link between government expenditure and national income for India. Their empirical results suggest that the causality between public expenditure and national income is neither Wagnerian nor Keynesian. Similarly, Ahsan et al. (1992) for the United States fail to detect any causality between public expenditure and national income. Afxentiou and Serletis (1996) and Ansari et al. (1997) conducted cross-country analysis and both studies do not found any evidence of Wagner's law. Similarly, Abizadeh and Yousefi (1998) found no evidence for the proposition. Besides, Bohl (1996) found that Wagner's law was valid only for the United Kingdom and Canada, out of the G7 countries, during the post-World War II period. Bagdigen and Cetintas (2003) do not found any causal nexus between national income and public expenditure for the Turkish case. Moreover, Frimpong and Oteng-Abayie (2009) supported neither Wagner's hypothesis nor its reverse for the West African Monetary Zone (WAMZ) countries. Recently, Verma and Arora (2010) confirmed the absence of any instantaneous impact of increasing GDP and the size of government expenditure in India. Taban (2010) found no consistent evidence that there is a relationship between government consumption spending

and economic growth in Turkey. Besides, Afzal and Abbas (2010) and Rauf, Qayum and Zaman (2012) asserted that there is no causality from national income to public expenditure and public expenditure to national income in Pakistan. Moreover, Ray and Ray (2012) confirmed the absence of short run causality between economic growth and developmental expenditure of government which neither supports Keynesian approach nor Wagner's law In India.

On the other hand, the studies by Chletsos and Kollias (1997) for Greece, Ghali (1998) for the 10 OECD countries, Demirbas (1999) for Turkey, Thornton (1999) and Chang (2002) for the 6 emerging countries, Kolluri et al. (2000) for the G7 countries, Islam (2001) for the United States, Al-Faris (2002) for the Gulf Cooperation Council (GCC) countries, Aregbeyen (2006) for Nigeria, Sideris (2007) for Greece, Kalam and Aziz (2009) for Bangladesh and Rehman et al. (2010) for Pakistan found causality from national income to public expenditure (as proposed by Wagner's law). Grullón (2012) and Salih (2012) supported the Wagner's law for Dominican Republic and Sudan, respectively. In contrast, the studies of Jiranyakul and Brahmasrene (2007) for Thailand, Pradhan (2007) for India, Babatunde (2008) for Nigeria, Magazzino (2010) for Italy and Ighodaro and Oriakhi (2010) for Nigeria confirmed the validity of Keynesian law of public expenditure. Besides, Ayo et al. (2011) reported bi-directional causality between government expenditures and economic growth both in the short run and in the long run for Nigeria.

The existing literature reveals that the debate pertaining to the public expenditure and economic growth relationship are well established and has been one that is unending. This debate is important for economic policy-related issues. For instance, recessionary (expansionary) periods impede (enhance) central authorities' abilities to stimulate their economy through fiscal measures unless the share of government spending to GNP increases (reduces). Besides, long-run estimates of the relationship between government expenditure and national output would permit the identification of a benchmark against which one can identify the fiscal policy stance adopted by particular governments. The government spending and national output relationship is also relevant for the debate on the sustainability of public finances, especially during the phase when governments struggle to restrain government spending. Therefore, the identification of this relationship provides a theoretical framework against which to formulate and judge fiscal policy adjustment plans concerning medium term budgetary objectives.

In this context, the present article examines the validity of Wagner's Law (the tendency for public expenditure to grow relative to national income) against the

contending Keynesian proposition (that it is the changes in public expenditure that trigger those of national income) using India's data over the period 1973-2012. The rest of the paper is organized as follows: Section 3 presents the methodology of the study. Section 4 offers empirical results and discussion. Finally, conclusions were presented in Section 5.

### METHODOLOGY AND DATA

Johansen's (1988) cointegration approach and Vector Error Correction Model (VECM) have been employed to investigate the causal nexus between public expenditure and economic growth in India. Before doing cointegration analysis, it is necessary to test the stationary of the series. The Augmented Dickey-Fuller (1979) test was employed to infer the stationary of the series. If the series are non-stationary in levels and stationary in differences, then there is a chance of cointegration relationship between them which reveals the long-run relationship between the series. Johansen's cointegration test has been employed to investigate the long-run relationship between two variables. Besides, the causal relationship between Gross Domestic Product (GDP) and public expenditure investigated by estimating the following Vector Error Correction Model (VECM) (Johansen, 1988):

$$\Delta X_t = \sum_{i=1}^{p-1} \Gamma_i \Delta X_{t-i} + \Pi X_{t-1} + \varepsilon_t \quad ; \quad \varepsilon_t | \Omega_{t-1} \sim \text{distr}(0, H_t) \quad (1)$$

where  $X_t$  is the  $2 \times 1$  vector  $(PE_t, G_t)'$  of log-Public Expenditure and log- Gross Domestic Product (GDP), respectively,  $\Delta$  denotes the first difference operator,  $\varepsilon_t$  is a  $2 \times 1$  vector of residuals  $(\varepsilon_{PE,t}, \varepsilon_{G,t})'$  that follow an as-yet-unspecified conditional distribution with mean zero and time-varying covariance matrix,  $H_t$ . The VECM specification contains information on both the short- and long-run adjustment to changes in  $X_t$ , via the estimated parameters  $\Gamma_i$  and  $\Pi$ , respectively.

There are two likelihood ratio tests that can be employed to identify the co-integration between the two series. The variables are cointegrated if and only if a single cointegrating equation exists. The first statistic  $\lambda_{trace}$  tests the number of cointegrating vectors is zero or one, and the other  $\lambda_{max}$  tests whether a single cointegrating equation is sufficient or if two are required. In general, if  $r$  cointegrating vector is correct. The following test statistics can be constructed as:

$$\lambda_{trace}(r) = -T \sum_{i=r+1}^n \ln(1 - \widehat{\lambda}_i) \quad (2)$$

$$\lambda_{max}(r, r + 1) = -T \ln(1 - \widehat{\lambda}_{r+i}) \quad (3)$$

where  $\hat{\lambda}_i$  are the eigen values obtained from the estimate of the  $\Pi$  matrix and  $T$  is the number of usable observations. The  $\lambda_{trace}$  tests the null that there are at most  $r$  cointegrating vectors, against the alternative that the number of cointegrating vectors is greater than  $r$  and the  $\lambda_{max}$  tests the null that the number of cointegrating vectors is  $r$ , against the alternative of  $r + 1$ . Critical values for the  $\lambda_{trace}$  and  $\lambda_{max}$  statistics are provided by Osterwald-Lenum (1992).

Johansen and Juselius (1990) showed that the coefficient matrix  $\Pi$  contains the essential information about the relationship between  $PE_t$  and  $G_t$ . Specifically, if  $\text{rank}(\Pi) = 0$ , then  $\Pi$  is  $2 \times 2$  zero matrix implying that there is no cointegration relationship between  $PE_t$  and  $G_{t-n}$ . In this case the VECM reduces to a VAR model in first differences. If  $\Pi$  has a full rank, that is  $\text{rank}(\Pi) = 2$ , then all variables in  $X_t$  are  $I(0)$  and the appropriate modelling strategy is to estimate a VAR model in levels. If  $\Pi$  has a reduced rank, that is  $\text{rank}(\Pi) = 1$ , then there is a single cointegrating relationship between  $PE_t$  and  $G_t$ , which is given by any row of matrix  $\Pi$  and the expression  $\Pi X_{t-1}$  is the error correction term. In this case,  $\Pi$  can be factored into two separate matrices  $\alpha$  and  $\beta$ , both of dimensions  $2 \times 1$ , where 1 represents the rank of  $\Pi$ , such as  $\Pi = \alpha\beta'$ , where  $\beta'$  represents the vector of cointegrating parameters and  $\alpha$  is the vector of error-correction coefficients measuring the speed of convergence to the long-run steady state.

If Public Expenditure and Gross Domestic Product are cointegrated, then causality must exist in at least one direction (Granger, 1988). Granger causality can identify whether two variables move one after the other or contemporaneously. When they move contemporaneously, one provides no information for characterising the other. If “X causes Y”, then changes in X should precede changes in Y. Consider the VECM specification of Equation (1), which can be written as follows:

$$\Delta PE_t = \sum_{i=1}^{p-1} a_{PE,i} \Delta PE_{t-i} + \sum_{i=1}^{p-1} b_{PE,i} \Delta G_{t-i} + a_{PE} z_{t-1} + \varepsilon_{PE,t} \quad (4)$$

$$\varepsilon_{i,t} | \Omega_{t-1} \sim \text{distr}(0, H_t)$$

$$\Delta G_t = \sum_{i=1}^{p-1} a_{G,i} \Delta PE_{t-i} + \sum_{i=1}^{p-1} b_{G,i} \Delta G_{t-i} + a_G z_{t-1} + \varepsilon_{G,t} \quad (5)$$

where  $a_{PE,i}$ ,  $b_{PE,i}$ ,  $a_{G,i}$ ,  $b_{G,i}$  are the short-run coefficients,  $z_{t-1} = \beta' X_{t-1}$  is the error-correction term which measures how the dependent variable adjusts to the previous period's deviation from long-run equilibrium from equation (1), and  $\varepsilon_{PE,t}$  and  $\varepsilon_{G,t}$  are residuals.

In the above equations of Vector Error Correction Model, the unidirectional causality from Gross Domestic Product-to-Public Expenditure (GDP Granger causes Public Expenditure) requires: (i) that some of the  $b_{PE,i}$  coefficients,  $i = 1, 2, \dots, p-1$ , are non zero and/or (ii)  $a_s$ , the error-correction coefficient in Equation (4), is significant at conventional levels. Similarly, unidirectional causality from Public Expenditure-to-Gross Domestic Product (Public Expenditure Granger causes GDP) requires: (i) that some of the  $a_{G,i}$  coefficients,  $i = 1, 2, \dots, p-1$ , are non zero and/or (ii)  $a_G$  is significant at conventional levels. If both variables Granger cause each other, then it is said that there is a two-way feedback relationship between  $PE_t$  and  $G_t$  (Granger, 1988). These hypotheses can be tested by applying Wald tests on the joint significance of the lagged estimated coefficients of  $\Delta PE_{t-i}$  and  $\Delta G_{t-i}$ . When the residuals of the error-correction equations exhibit heteroskedasticity, the t-statistics are adjusted by White (1980) heteroskedasticity correction.

Finally, the Impulse Response Function (IRF) has been employed to investigate the time paths of log of public expenditure in response to one-unit shock to the log of gross domestic product and vice versa. The impulse response function analysis is a practical way to visualize the behaviour of a time series in response to various shocks in the system (Enders, 1995). The plot of the IRF shows the effect of a one standard deviation shock to one of the innovations on current and future values of the endogenous variables. This study includes two variables, viz. public expenditure and Gross Domestic Product, for the Impulse Response Function technique.

In this study, the annual time series data of the two variables under consideration, namely the Gross Domestic Product (GDP) and the public expenditure of India, have been carried out from the year 1973 to 2012. The real Gross Domestic Product (GDP) is used as the proxy for economic growth in India and we represent the economic growth by using the constant value of Gross Domestic Product (GDP) measured in Indian rupee. The total expenditure of the central government of India has been considered for public expenditure under the study. All necessary data for the sample period are obtained from the Handbook of Statistics on Indian Economy, published by Reserve Bank of India, Mumbai.

## EMPIRICAL RESULTS AND DISCUSSION

The Augmented Dickey-Fuller test (ADF) was employed to test the stationarity of the GDP and public expenditure. The results are presented in Table 1. The test reveals that both variables become stationary when their first differences are used and it can be concluded that they have unit roots. In other words, it can be determined that both the variables- Public Expenditure and GDP- are integrated in order of one,  $I(1)$ .

**Table 1** Augmented Dickey-Fuller test for unit roots

Sl.No.	Variable	Constant	Constant & trend	Without constant & trend
I	Levels			
1.	$\ln G_t$	2.127	-0.666	2.132
2.	$\ln PE_t$	-0.692	-1.847	2.609
II	First difference			
1.	$\Delta \ln G_t$	-3.619*	-4.449*	-3.341*
2.	$\Delta \ln PE_t$	-4.403*	-4.589*	-2.666*

Notes: Parenthesis shows t-value. PE and G are the Public Expenditure and Gross Domestic Product, respectively. \* – indicates significance at one and five per cent level, respectively. Optimal lag length is determined by the Schwarz Information Criterion (SIC).

Johansen's Cointegration test was performed to examine the long-run relationship between the public expenditure and GDP and its results are presented in Table 2.

**Table 2** Johansen cointegration test

$H_0$	$H_1$	Eigen value	95% CV	99% CV	
					$\lambda_{\text{trace}}$ test
$r = 0$	$r \geq 1$	0.5098	32.006*	19.96	24.60
$r \leq 1$	$r \geq 2$	0.1614	6.340	9.24	12.97
					$\lambda_{\text{max}}$ test
$r = 0$	$r = 1$	0.1911	25.666*	15.67	20.20
$r = 1$	$r = 2$	0.0639	6.340	9.24	12.97

Notes: \* – indicates significance at one per cent level. The significance of the statistics is based on 1 per cent critical values obtained from Osterwald-Lenum (1992).  $r$  is the number of cointegrating vectors.  $H_0$  represents the null hypothesis of presence of no cointegrating vector and  $H_1$  represents the alternative hypothesis of presence of cointegrating vector.

The Johansen's cointegration tests result reject the null hypothesis of no cointegration at the one per cent significance level. Thus, it can be concluded that GDP and public expenditure are cointegrated or they co-move in the long run.

**Table 3** Normalized cointegrating coefficients

Variables	Cointegration vector	t-statistics
PE	1.0000	-
G	2.414	8.206* (0.294)
c	19.243	4.799* (4.009)

*Notes:* \* indicates significance at 1% level (Standard error in parentheses). PE and G are the Public Expenditure and Gross Domestic Product, respectively.

Table 3 shows the estimated cointegration equation normalized on the natural log values of public expenditure on GDP. According to the results, there is a statistically significant positive relationship between GDP and public expenditure in India. According to Granger Representation Theorem, if there is evidence of cointegration between two or more variables, then a valid error correction model exist between the two variables. The results of the estimated Vector Error Correction Model (VECM) are presented in Table 4.

In equation (4), the error correction term is found to be negative and significant at one percent level. This implies that the cointegrated series is in disequilibrium in the short run, it is public expenditure that makes greater adjustment in order to reestablish the equilibrium. In other words, GDP leads to the public expenditure in the long-run. Moreover, the lagged GDP variable in equation (4) is found to be significant indicating that the GDP leads the public expenditure. Besides, the Wald-F-statistics for  $b_s$  is found to be  $[\sum_{i=1}^k b_s(\text{Wald-F}) = 2.828]$  statistically significant at ten per cent level, and whereas for  $a_s$ ,  $[\sum_{i=1}^k a_s(\text{Wald-F}) = 0.287]$  it is statistically insignificant. This implies a significant causality running from GDP to public expenditure in the short-run. Overall, the empirical results confirm the unidirectional causation runs from economic growth to public expenditure in both short-run and in the long-run.



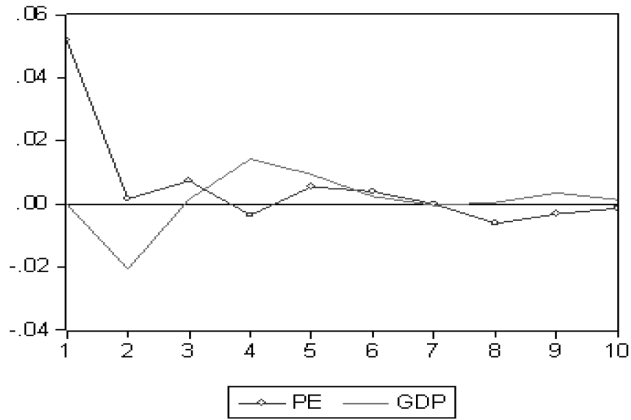
**Table 4** Vector error correction model estimates

Independent variables	Dependent variable	
	$\Delta PE_t$ (4)	$\Delta G_t$ (5)
c	-0.0020 (-0.235)	0.0038 (0.382)
$\Delta PE_{t-1}$	0.2408 (1.001)	-0.1202 (-0.435)
$\Delta PE_{t-2}$	0.1586 (0.942)	-0.0940 (-0.486)
$\Delta G_{t-1}$	-0.3172 (-2.060)**	-0.6257 (-3.538)*
$\Delta G_{t-2}$	-0.1925 (-1.208)	-0.3705 (-2.024)**
$Z_{t-1}$	-0.5325 (-3.767)*	0.0656 (0.190)
$R^2$	0.5746	0.3251
Wald F-Statistics	2.8288 ***	0.2876

Notes: Optimal lag length is determined by the Schwarz Information Criterion (SC): PE and G are the Public Expenditure and Gross Domestic Product, respectively. Parenthesis shows t-statistics. \*, \*\* and \*\*\* denote the significance at the one, five and ten per cent level, respectively.

Figure 1 presents the impulse response function. The impulse response function graphically illustrates the expected response of GDP to the innovation in public expenditure and by GDP itself and also show the response of public expenditure to the innovation in GDP and by public expenditure itself. This function enables characterization of the dynamic interactions among variables and allows us to observe the speed of adjustment of variables in the system. Figure 1 plots the response of public expenditure to shocks in GDP and vice versa. A shock in GDP has negative effect on public expenditure at beginning and then has a positive effect throughout the longer time period. Besides, the response of GDP to public expenditure shock begins with immediate positive effect and has greater negative effect on GDP for the longer time period. This indicates that there is significant positive impact of GDP on public expenditure and not vice versa. This result is consistent with the earlier findings of Vector Error Correction model.

Response of PE to Cholesky  
One S.D. Innovations



Response of GDP to Cholesky  
One S.D. Innovations

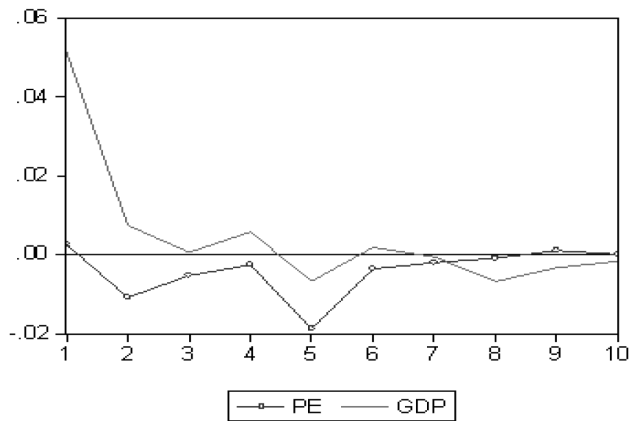


Figure 1 Impulse response function

### CONCLUSION

The purpose of this study is to investigate the causal nexus between public expenditure and economic growth in India using cointegration approach and error correction model. The analysis was carried out over the period 1973 to 2012. The Cointegration test result confirms the existence of long-run equilibrium relationship between public expenditure and economic growth in India. The empirical results based on the error-correction model estimate indicates one-way causality runs from

economic growth to public expenditure in the short-run and long-run, supporting the Wagner's law of public expenditure. The present study suggests that the public expenditure is growing rapidly than the income of the economy and hence validates Wagner's law in the case of India. This is mainly due to the expansion of revenue expenditure on subsidies, interest payments, administrative and defence services which are non-developmental in nature. Therefore, the Indian government must scrutinize the non-developmental expenditure and has to give emphasis on expenditure towards developmental in effect.

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