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ADDRESSING THE PARADOX OF PUBLIC EXPENDITURE – ECONOMIC GROWTH NEXUS: AN ECONOMETRIC APPROACH

Since the introduction of economic reforms, Indian economy has been rapidly growing. Simultaneously, the government spending has also increased by multiple times. Interestingly, rapid rise in public expenditure has occurred during the era of speedy privatisation. The central issue of discussion is whether high growth is attributed to increased government spending and/or higher government spending is owing to rising economy. There are several theoretical propositions and empirical findings attempting to solve this puzzle but with no unanimity and their inferences are rather highly divided and fragmented. In this pretext, the present paper makes an effort to re-examine the direction of flow of relationship, nature of relationship and size of the relationship between government expenditure and economic growth in India in the long run through econometric modelling. In the course of investigating the nexus of relationship between economic growth and government spending, the study also aims to test whether Indian scenario validates the Wagner's law or supports the Keynesian growth hypothesis. The underlying subject is investigated based on the data covering the economic reform period from 1991-1992 to 2015-2016. Application of appropriate econometric techniques like cointegration test, estimation of Vector Auto Regression (VAR) model, Granger causality test, impulse response function and variance decomposition provide evidences of long-term relationship between growth and government spending. Results show that the size of the public sector is defined positively by the level of GDP growth in the long run and similarly, the variability in GDP is explained positively by the government expenditure. The findings of the study have evidences to support both Wagner's law and Keynesian theory.

JEL: E01; H50; C50

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India went through the biggest economic reforms starting from 1991 by liberalising the policies, intensifying the cross boarder business transactions and even more significantly, entrusting larger share of economic activities to the private sector. Very interestingly, with the dwelling private sector, the size of public sector has not diminished in India. Rather, the spending of the government towards different sectors has swelled enormously from Rs. 1114 billion in 1991-92 to Rs. 17854 billion in 2015-16. This trend has adversely affected the fiscal management and consequently the government debt position. During such period of precariously mounting fiscal figures, Indian economy saw enormous growth. The GDP of India has reached to Rs. 136753 billion in 2015-16 from Rs. 6738 billion in 1991-92. This

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reflects on two aspects: Firstly, the era of rigorous privatisation has seen enormous rise in public spending; and secondly, increase in public spending and rise in economic growth occur simultaneously. Amidst such scenario, the emerging question is on the relationship between the growth and government spending. Many theoretical propositions and empirical studies have established links between growth and spending. The central issue of discussion was whether high growth is attributed to increased government spending and/or higher government spending is owing to rising economy. The role of exogenous elements in such links was not declined. As discussed in the next section, such theoretical propositions are not unanimous regarding the nature, direction and size of relationship between economic growth and government. Even the empirical results are largely fragmented. Under this backdrop, the present paper makes an effort to re-examine the direction of flow of relationship, nature of relationship and size of the relationship between the government expenditure and economic growth in India in the long run through econometric modelling. In the process of investigating the nexus of relationship between economic growth and government spending, the study also aims to test whether Indian scenario validates the Wagner's law or supports Keynesian growth hypothesis.

Theoretical propositions and contradictions

Several theories discuss the nature and direction of relationship between government expenditure and economic growth. It was Adolph Wagner (1883) who laid down the foundation for such a debate. Keynes (1936), classical economists and Solow (1956) among many others propounded their theoretical perspectives. Each of these growth theories disagrees with other theories.

Adolph Wagner (1883) propounded the 'law of the expanding state role', a model advocating that public expenditure is endogenous to economic growth, and that there exist long-run tendencies for public expenditure to grow relatively to economic growth. More specifically, the theory suggests the existence of the causal relationship between public expenditure and national income running from national income to public expenditure. Wagner advocated that public expenditure is an endogenous factor or an outcome, but not a cause of economic growth. Wagner's law states that "as the economy develops over time, the activities and functions of the government increase". This perception of Wagner can be presented mathematically as:

$$GE_t = f\,(Y_t)$$

GE_t refers to the size of government (expenditure), Y is the level of economic growth and t stands for time. This functional form was developed by Peacock-Wiseman (1961) to facilitate quantitative empirical research.

Based on the study of history through comprehensive comparisons of different countries and different times, Wagner arrives at the inference that among progressive societies, “an increase regularly takes place in the activity of both the Central Government and Local Governments, constantly undertake new functions, while they perform both old and new functions more efficiently and more completely. In this way economic needs of the people to an increasing extent and in a more satisfactory fashion, are satisfied by the Central and Local Governments." This law was later supported strongly by Rostow (1960). His Stages of Growth Model argued that increase in government expenditure is related to the pattern of economic development. Though Wagner’s law is applicable to modern progressive economies, vagueness persists as he did not estimate the extent to which public expenditure would change for a given shock in economic growth and time lag involved in the process. This could be attributed to the fact that his theory is evolved primarily by the historical experience.

Keynes (1936) contradicted with Wagner postulating that causality runs from public expenditure to national income. This implies that government expenditure is an exogenous factor and it is an instrument to government for increasing economic growth. The standard effective demand theory of Keynes advocates positive impact of autonomous government spending on national income. Keynes firmly believes that fiscal policy is an effective instrument available to the government to stimulate economic activities in the country and thereby the economic growth. Keynesian economists, later, argued that the government spending is significant in achieving short run stability and long run growth. For Keynes, every expenditure, including recurrent expenditure, contributes positively to growth. Keynes developed multiplier principle to ascertain the impact of public spending on growth. Thus the Keynesian model of economic growth can be presented in a functional relationship as:

$$Y_t = f\ (GE_t).$$

The equation reflects that as the government spending increases overtime (GE_t) national income (Y_t) raises due to multiplier effect on aggregate demand.

Classical economists also advocated that the causal relationship runs from government expenditure to economic growth. However, influenced by the laissez-faire principle of Adam Smith and David Ricardo, this school of thought presumes negative functional relationship between government spending and economic growth. They believe that with higher government expenditures countries are expected to experience lower economic growth. Further, the expenditure of the government in the free economy should be limited to bare necessities, otherwise this would hinder the growth.

Disagreeing with Keynes, Solow (1956) builds up a model arguing that there exists no long run impact of public spending on economic growth. His argument is based on the proposition that the long run economic growth is largely driven by factors such as growth of population, the rate of growth of labour force, and the rate of technological progress which is exogenous. Hence for Solow, economic growth is determined mainly by exogenous factors.

To summarise the contradictions in the theoretical propositions, Wagner advocates that higher economic growth leads to increased government expenditure; Keynes argument says that increase in government expenditure results in high growth; classical economists predict that increase in government spending causes a fall in economic growth; and Solow rejects all such arguments to arrive at his conclusion that government expenditure has no long run impact on economic growth.

Mapping the empirical literature

Wu.et.al. (2010) studied the appropriateness of Wagner's law. The study was conducted by applying the panel data set for 182 countries that cover the period from 1950 to 2004. Results show that government spending is helpful to economic growth regardless of how we measure the government size and economic growth. Later, when the countries are disaggregated by income levels and the degree of corruption, results confirm the bi-directional causality between government activities and economic growth for the different subsamples of countries, with the exception of the low-income countries owing to their inefficient governments and inferior institutions. Empirical results strongly support Wagner's hypothesis in high income countries but lacks evidences in low income countries. The results contradict with the findings of Liu, et al. (2008) who examined the causal relationship between economic growth and government expenditure in US for the period 1947-2002. The causality test results revealed that that government expenditure is a source of economic growth. The paper had evidences to conclude that Keynesian hypothesis exerts more influence than the Wagner‘s law in US.

Ighodaro and Oriakhi (2010) tested the Wagner's hypothesis for Nigeria using both aggregated government expenditure and disaggregated expenditure for 1961 to 2007. The result does not have any evidence to support Wagner's hypothesis. But Keynesian hypothesis was validated in all the estimations. However, a study by Menyah and Yemane (2013) provides different perspective to this discussion. They investigated the relationship between government expenditure and economic growth. The objective was to test Wagner's Law which postulates that as real income increases there is a tendency for the share of public expenditure to increase relative to national income. The study was focused on Ethiopia. The bounds test approach to cointegration adopted in the study provides robust evidence of a long-run relationship between government expenditure and GDP. Using four long-run estimators, the study explores that a 1 percent increase in income leads to a 1.73–1.79 percent increase in government expenditure. Applying a modified version of the Granger causality test, they found a unidirectional causality running from GDP to government expenditure and not the other way round. This supports the Wagnerian hypothesis. Since there was no causality running from government expenditure to income, the evidence suggests that the Keynesian view that government expenditure can be an effective policy instrument for promoting economic growth in Ethiopia was not supported.

Chude and Chude (2013) using the Error Correction Model (ECM) examined the long run and short run effects of public expenditure in education on economic growth in Nigeria. It was found that the total expenditure on education has high, statistically significant and positive long-run effect on economic growth. Similarly, in a paper that focused on the effects of government size and composition of public expenditure on economic growth, Martins and Veiga (2014) found that government size as a percentage of GDP has a quadratic effect on the growth rate of the human development measured in terms of Human Development Index in developed and high income countries. Yasin (2013) examined the effect of government expenditure on economic growth of Sub-Saharan Africa using panel data. The result of the study also found that government expenditure, trade openness, and private investment spending have positive and significant effect on economic growth.

Results of an empirical study run by Abu and Abdullahi (2010) provide astonishing conclusions. It was observed that rising government expenditure has not lead to meaningful development in Nigeria. By employing a disaggregated analysis, the study reveals that government total capital expenditure, total recurrent expenditures, and government expenditure on education have negative effect on economic growth, while a rising government expenditure on transport and communication, and health results in an increase in economic growth. The results partially support the views of classical theory. Similar study of Alshahrani and Alsadiq (2014) estimated the short run and long run effects of different types of government expenditures on economic growth in Saudi Arabia by employing annual data over the period 1969-2010. The findings indicate that public investments in aggregate and healthcare expenditure in segregation stimulate growth in the long run.

Jamshaid and Siddiqi (2010) examined the nature and the direction of causality between public expenditure and economic growth in Pakistan applying the Toda-Yamamoto causality test for annual data within the period of 1971-2006. The study concludes with supporting Wagner's law that there is a unidirectional causality running from GDP to government expenditure. Dissimilar results were obtained by Mwafaq (2011) who investigated the impact of public expenditure on economic growth in Jordan using annual data for the period 1990-2006. The study concludes that the government expenditure at the aggregate level has positive impact on the growth of GDP, supporting the Keynesian's theory.

Nyambe and Kanyeumbo (2015) ascertained the role that government expenditure, household expenditure and inflation plays in developing the Namibian economy for the period between 1980 and 2011 using multiple regression model. The results put forward the existence of a positive relationship between economic growth, government expenditure, household expenditure and inflation. This rejects the argument of classical economists that government spending may negatively affect the economic growth.

Adamu and Hajara (2015) examined the impact of public expenditure on economic growth in Nigeria using time series data for the period 1970-2012. The adopted disaggregate analysis by classifying expenditure into capital and recurrent expenditure. While economic growth was measured with real GDP. Application of Granger causality test demonstrated a unidirectional causality running from the expenditure variables to economic growth in validation of the Keynesian theory.

In one of the recent studies, Ebong et al (2016) tried to assess the impact of government capital expenditure on economic growth in Nigeria during 1970 and 2012. A multiple regression model based on a modified endogenous growth framework was utilized to capture the interrelationships among capital expenditures on agriculture, education, health economic infrastructure and economic growth. Drawing on the error correction and cointegration specifications, an OLS technique was used to analyse annual time series. Government capital expenditures had differential effects on economic growth. Capital expenditures on agriculture did not exert any significant influence on growth both in the long and short runs. Capital expenditure on education and infrastructure appears to have significant and positive impact on growth both in the short and long runs. Even capital expenditure on health has significant impact but surprisingly it was a negative impact. It was found that in the case of Nigeria, increasing public expenditure would not crowd out private investment. The results have evidences to support both Keynesian theory and classical theory.

Iheanacho (2016) examined the long run and short run relationship between public expenditure and economic growth in Nigeria over the period of 1986-2014, using Johansen cointegration and error correction approach. The study splits the public expenditure into two components of public sector expenditure and gross capital formation ratio and the result shows that recurrent expenditure is the major driver of economic growth in Nigeria. Results show a negative and a significant long run relationship between economic growth and recurrent expenditure coexists with a positive short run relationship, highlighting the dual effects of recurrent expenditure on economic growth in Nigeria. For the capital expenditure, this study documents negative and significant long run effect on economic growth. The variance decomposition confirms the collective contribution of public expenditure on economic growth.

Though abundant studies were made on the underlying subject, very limited empirical research are available for Indian data. Srinivasan (2013) investigated 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. Srinivasan's findings do not corroborate with the results of Gangal and Gupta (2013). Their study explored the positive impact of public expenditure on economic growth. Further, applying Granger causality, authors confirmed the presence of a unidirectional relationship running from public expenditure to GDP. This paper hence supports the causal direction underlined by Keynes.

These studies attempted to validate the economic theories propounded by renowned economists of past. As reflected in the review of such studies, primarily, conclusions do not share unanimity on the nature and direction of relationship between government expenditure and economic growth. Some studies support Wagner's hypothesis that the size of public expenditure being decided over time depends on the changes in the level of economic progress. While others validate the Keynesian theory of economic growth being highly dependent on the government spending. Yet, a few studies also agreed to the classical notion of growth being negatively affected with increased government spending. This ambiguity in the existing literature demands a fresh look into the underlying issue. Further, empirical methodology also differs in such studies. Most of these studies applied either OLS method or cointegration, error correction model and causality. Though they provide the causal direction between the two factors, results derived from them need to be validated, which was not carried out by these studies. Variance decomposition and impulse response function would ascertain accurately the sensitivity of one variable to the shocks of the other variable over the long period of time. In Indian context, very limited studies are available on the issue and even their findings do not corroborate each other. Under such pretext, the present study revisits the nexus between government spending and economic growth.

Research Methodology

Variables

The present study deals with two variables: public spending and economic growth. Public spending is measured by Government Expenditure (GE) and the Gross Domestic Product (GDP) is the proxy of economic growth. Variables chosen are for Indian scenario. The absolute values of the selected variables are taken into account. However, while estimating the econometric models, the absolute values are converted to log values.

Data Source and Study Period

Essential data are procured from Reserve Bank of India (RBI) Handbook of Statistics on Indian Economy. The study is based on time series data on annual basis from 1991-92 to 2015-16. It covers data of 25 years of economic reform era in India. Since 1991 series of economic reforms were launched in India and the role of public sector was redefined to provide impetus to the private sector. Since then Indian economy has grown drastically. It is interesting to study the role of government expenditure in growth in the changed dynamics of public sector.

Estimation Techniques

The present study has adopted certain econometric tools and techniques using E-views software to analyse the nature, direction and size of relationship between government spending and economic growth in India. Following are the econometric techniques employed to estimate the nexus of relationship between public expenditure and economic growth.

- Unit root test to test the stationarity of data
- Co-integration test to examine whether the two variables under study are cointegrated in the long run
- Causality test to identify the causal direction of flow of relationship between the variables
- Fitting an error correction model, if co-integration is established, otherwise, estimate a vector auto regression model
- Impulse response function to ascertain the response of one endogenous variable to the shocks of other endogenous variable
- Variance de-composition to measure the degree of variability in an endogenous variable because of changes in its own value and also because of changes in the other endogenous variable

1. Unit Root Test. Any empirical research using time series data assumes that the underlying time series is stationary. A data series is said to be stationary when its mean and variance are constant overtime and the value of covariance between two time periods depends only on the distance or lag between the two time periods and not on the actual time at which the covariance is computed (Gujarati and Sangeetha, 2007). The present study employs unit root test to test the stationarity of the time series data of GDP and government expenditure which are used for the study.

The stationarity status of GDP and government spending has been tested using the Augmented Dickey Fuller (ADF) method. ADF test is the modified version of Dickey-Fuller (DF) test. The ADF makes a parametric correction in the original DF test for higher order correlation by adding lagged difference terms of the dependent variable to the right hand side of the regression. The ADF test, in the present study, consists of estimating the following regression.

$$(1) \quad Yt = bo + \beta \Delta Yt_{-1} + \mu_1 \Delta Yt_{-1} + \mu_2 \Delta Yt_{-2} + \sum_{i=1}^{m} \mu i \Delta Yt_{-I} + et$$

Y_t represents the series to be tested, bo is the intercept term, β is the coefficient of intercept in the unit root test, μ_1 is the parameter of the augmented lagged first difference of the dependent variable, Y_t represents the i^{th} order autoregressive process, et is the white noise error term. The number of lagged difference terms to include is determined empirically, the idea being to include enough terms so that the error term is serially uncorrelated (Gujarathi and Sangeetha, 2007).

The stationary condition under ADF test requires that: p value is less than 1 (IpI <1). In other words, the computed t value should be more negative than the critical t value (t statistic < critical value). The computed t statistic will have a negative sign and large negative t value is generally an indication of stationarity (Gujarathi and Sangeetha, 2007).

2. Co-integration Test. If the unit root test ensures the stationarity of the time series data and all the data sets are integrated at the same order, the data sets are available for further analysis to examine whether GDP and government spending are cointegrated and share a long run relationship. To investigate the co-integration between GDP and government expenditure, Johansen's Co-integration method is administered. The Johansen method of cointegration can be tested using the following equation.

(2) $$Xt = a + \sum_{j=1}^{p} \beta j\, Xt - j + et$$

where Xt is an n×1 vector of non-stationary I(1) variables, a is an n×1 vector of constants, p is the maximum lag length, βj is an n×n matrix of coefficient and et is a n×1 vector of white noise terms. The coefficient value (β) indicates the degree of co-integration or relationship, while the sign preceding to the coefficient indicates whether the long run relationship between the variables is positive or negative.

3. Vector Error Correction Model (VECM). Johansen's co-integration technique examines the presence or absence of only the long term balanced relations between government expenditure and GDP. It does not bring out any short run disequilibrium if it exists. In order to cover the shortage, correcting mechanism of short term deviation from long term balance could be adopted. Therefore, under the circumstances of long term causality, short term causalities should be further tested (Ray, 2012) using the Vector Error Correction Model (VECM). It is also significant to note that VECM could be estimated only if the cointegration between the variables is established. The VECM analyses whether error correction mechanism takes place if some disturbance comes in the equilibrium relationship. In other words, it measures the speed of convergence to the long run steady state of equilibrium. Thus the Johansen co-integration equation (2) has to be turned into a vector error correction equation as follows.

(3) $$\Delta Xt = a + \sum_{j=1}^{p-1} \Gamma j\, \Delta Xt - j + \Pi Xt - p + et$$

where Δ is the first difference operator, Γj is $-\sum_{j=1+1}^{p} \beta j$ and Π is equal to $-1 + \sum_{j=1+1}^{p} \beta j$ and is an identity metrics.

4. Vector Auto Regression (VAR) Model. If the cointegration test fails to show the long run cointegration relationship between the GDP and government expenditure, the long-run dynamics of the relationship between the model variables concerned will be estimated by running Vector Auto-regression Model (VAR). This model does not make any priory assumption of which variable is endogenous and which is exogenous. In addition, a VAR model allows us to study the Impulse Response Function and Variance Decomposition for the variables.

(4) $$Yt = b_{10} - b_{12}\mathrm{Xt} + \mathrm{Y}_{11}\mathrm{Yt}_{-1} + \mathrm{Y}_{12}\mathrm{Xt}_{-1} + \varepsilon\mathrm{yt}$$

(5) $$Xt = b_{20} - b_{21}Yt + \mathrm{Y}_{21}\mathrm{Yt}_{-1} + \mathrm{Y}_{22}\mathrm{Xt}_{-1} + \varepsilon\mathrm{xt}$$

where *b* is the unknown coefficient, $\varepsilon\mathrm{yt}$ and $\varepsilon\mathrm{xt}$ are the error terms, t_{1} is the lag term, Y and X are the variables used in the study viz. GDP and government expenditure.

5. Causality Test. After testing for long run cointegration between GDP and government expenditure and long run convergence of short run deviation, study may test the presence of short run causal relationship between GDP and government expenditure. The causal direction of flow of relationship between the variables is studied in this paper by administering the Granger causality test. Causality is a kind of statistical feedback concept which is widely used in the building of forecasting models (Ray, 2012). The Granger causality Test (1969, 1988) seeks to determine whether past values of a variable help to predict changes in another variable. The Granger causality technique measures the information given by one variable in explaining the latest value of another variable. In addition, it also says that variable Y is Granger caused by variable X if variable X assists in predicting the value of variable Y. If this is the case, it means that the lagged values of variable X are statistically significant in explaining the variable (Ray, 2012).

The causality test will examine the reaction between GDP and government expenditure such as, if variable government expenditure Granger cause GDP and GDP also Granger cause to government expenditure. This implies that the value after GDP can help us to expect the value for the next period of government expenditure and also the value after government expenditure can help us to expect the value for the next period of GDP respectively. The Granger method involves the estimation of the regression equations. In this study of two-way variables (government expenditure & GDP) the following two equations are the formula for Granger causality regression test.

If the causality runs from Government Expenditure (*GE*) to GDP, then the Granger causality regression equation is;

$$(6) \qquad GDPt = n + \sum_{a11} GDP_{t-1} + \sum_{\beta 11} GE_{t-1} + \varepsilon_1 t$$

If the causality runs from GDP to Government Expenditure (*GE*) then the Granger causality regression equation is;

$$(7) \qquad GE = n + \sum_{a12} GE_{t-1} + \sum_{\beta 12} GDP_{t-1} + \varepsilon_2 t$$

From the equation (6), GE_{t-1} Granger causes GDP_t if the coefficient of the lagged values of *GE* as a group β_{11} is significantly different from the zero based on F-test. Similarly, from equation (7), GDP_{t-1} Granger causes *GE* if β_{12} is statistically significant.

6. Impulse Response Function. Impulse response function provides even more accuracy on the relationship between the variables in the system. This econometric technique explains the responsiveness of the endogenous variable in the system to shocks to each of the other endogenous variables. For each endogenous variable in the system, a unit shock is applied to the error, and the effects over time are noted. Impulse response function estimates accurately the percentage change in GDP for a given percentage change in the government spending in the long run. It also measures the percentage change in government expenditure in the long run for a given shock administered to GDP. The impulse response function helps in visualising better picture on the direction, nature and size of relationship in the long run. This is an improvement over causality test which brings out only short run causal direction.

7. Variance Decomposition. The vector auto regression estimation shows only the impact of predictor on the dependent variable. It does not accurately measure how much variability in a dependent variable is due to the changes or shocks in the other endogenous variable and how much is owing to its own shocks. Further, regression does not measure variability in an endogenous variable at different stages in a time horizon due to shocks in the other endogenous variable. Variance decomposition technique is applied in this study which measures accurately how much variability in GDP is due to the changes in government expenditure in the long run, and how much is owing to its own shocks. Further it also decomposes the variability in government expenditure among the shocks in GDP and also government expenditure itself. In the general linear model, the relationship between the two variables is captured by the linear equation:

$$Y = a + bX + c.$$

Y = dependent variable or response variable, and X = independent variable or explanatory factor.

With every unit change or shocks in X, there is a corresponding variation in Y. The variance decomposition focuses on the 'response variable', i.e. Y which responds to the variations in the independent variable, i.e. X. Specifically the variance of Y for the shocks of other endogenous variable in the model can be presented as follows:

$$Var(Y) = E(Var[Y|X]) + Var(E[Y|X])$$

In this equation Var(Y) is variance of Y, E(Var[Y|X]) is explained variation of Y directly due to changes in X and Var(E[Y|X]) reflects unexplained variation comes from somewhere other than X. Thus, the variance decomposition brings out the variance of Y owing to: (1) the expected variance of Y with respect to X, and (2) the variance of the "expected variance of Y" with respect to X. In other words, the variance of Y is its expected value plus the "variance of this expected value."

In summary, the result derived through this process enables to isolate to appreciate the fact that the response in Y has a variation; this variation is comprised of two components. When these components are decomposed they are one type of variation that is explained by the changes of X and another variance that is completely due to chance stance, i.e. unexplained.

Analysis of empirical results

Since the study uses time series data for analysis, it is pertinent to ensure the stationarity of the data series. The Augmented Dickey Fuller (ADF) method of testing the unit root has been employed in the study and the results are presented in Tables 1 and 2. It could be derived from the results that though both GDP and Government Spending data were not stationary at level (I(0)), they attain stationarity after second order differencing (I(2)). Hence, the hypotheses that: GDP has a unit root; and government expenditure has a unit root are rejected. In the case of GDP, the hypothesis is rejected at 5% level of significance as the t value becomes smaller than the critical value at second order difference at 5% level of significance. While, in case of government expenditure, the hypothesis is rejected at 1% level of significance. This in other words means that data series of both GDP and government expenditure do not have any unit root problem at 2nd order difference and hence data series are eligible to run through cointegration test.

Table 1

ADF Unit Root Test for GDP

Particulars	t-stat	Critical Value		Prob
At Level I(0)	0.073436	1% level	-4.416345	0.9948
		5% level	-3.622033	
		10% level	-3.248592	
At 2nd Diff I(2)	-4.196504	1% level	-4.467895	0.0172
		5% level	-3.644963	
		10% level	-3.261452	

Table 2

ADF Unit Root Test for Government Expenditure

Particulars	t-stat	Critical Value		Prob
At Level I(0)	-0.932137	1% level	-4.416345	0.9345
		5% level	-3.622033	
		10% level	-3.248592	
At 2nd Diff I(2)	-4.967858	1% level	-4.440739	0.0033
		5% level	-3.632896	
		10% level	-3.254671	

Following to the confirmation of stationarity of data series, the presence of a long-term relationship between GDP and government expenditure is examined through cointegration test by applying Johansen method. The results of Johansen cointegration test are presented in Table 3.

Table 3

Results of Johansen Co-integration test

Cointegration Test	Level	Max. Eigen Value	t-Statistic	C.V at 5%	Prob
Trace Test	H0: r=0 (none)	0.415605	11.89386	15.49471	0.1621
	H1: r≤1 (at most 1)	0.003445	0.075928	3.841466	0.7829
Max.Eigen	H0: r=0 (none)	0.415605	11.81793	14.26460	0.1177
	H1: r≤1 (at most 1)	0.003445	0.075928	3.841466	0.7829

* Trace test & Max.Eigen value tests indicate no cointegration at the 0.05 level.

While analysing the results of Johansen cointegration test, it is evident that both in trace test and Max.Eigen test at the null hypothesis, t-statistic is less than critical value at 5 percent level of significance. In other words this could be interpreted that economic growth and government expenditure are not cointegrated. With this, the hypothesis that there is no long run cointegration between GDP and government expenditure is accepted.

Since GDP and government expenditure are not cointegrated in the long run, vector error correction model (VECM) cannot be applied. In this case, fitting the data into a Vector Auto Regression (VAR) model is essential and the study did so. The results of VAR model is provided in Table 4.

Table 4

Results Vector Auto Regression (VAR) Model

Error Correction	D(GDP)	D(GE)
D(GDP(-1)	1.255773 (0.26209) [4.79147]	0.039954 (0.07079) [0.56438]
D(GDP(-2)	-0.450469 (0.22834) [-1.97277]	-0.005873 (0.06168) [-0.09521]
D(GE(-1)	1.812146 (0.87166) [2.07896]	1.627279 (0.23545) [6.91139]
D(GE(-2)	0.066146 (1.07612) [0.06147]	-0.873373 (0.29068) [-3.00462]
C	-76.74912 (442.180) [-0.17357]	180.9766 (119.440) [1.51521]

VAR analysis presented in Table 4 provided interesting results. Results imply that GDP do respond significantly to re-establish the equilibrium relationship once deviation occurs in government expenditure. It appears that GDP in India will converge towards its long run equilibrium after the change in government spending at lag 1. This implies that the value of current year's government expenditure defines and influences next year's GDP and this impact of current government expenditure on future economic growth is positive and is statistically significant. To be more precise in regard to the size of impact, 1 unit increase in the current government expenditure is predicted to lead to an increase in GDP by 1.8 units in the following year. And this prediction appears to be accurate by 95 percent level of confidence. This regression does not provide any evidences of government expenditure being predicted by the lagged values of GDP. This provides initial empirical evidence to support Keynesian theory. Wagner's law has not been validated by vector auto regression model. Specific conclusion cannot be arrived at without validating the VAR results by applying other appropriate econometric models.

Though VAR model predicts that government expenditure impacts GDP positively and the level of GDP growth does not influence the size of government spending, this direction of flow of relationship has to be validated by the causality test. The present paper runs popularly accepted pairwise Granger causality for this purpose and the results are presented in Table 5.

Table 5

Results of Granger Causality Test

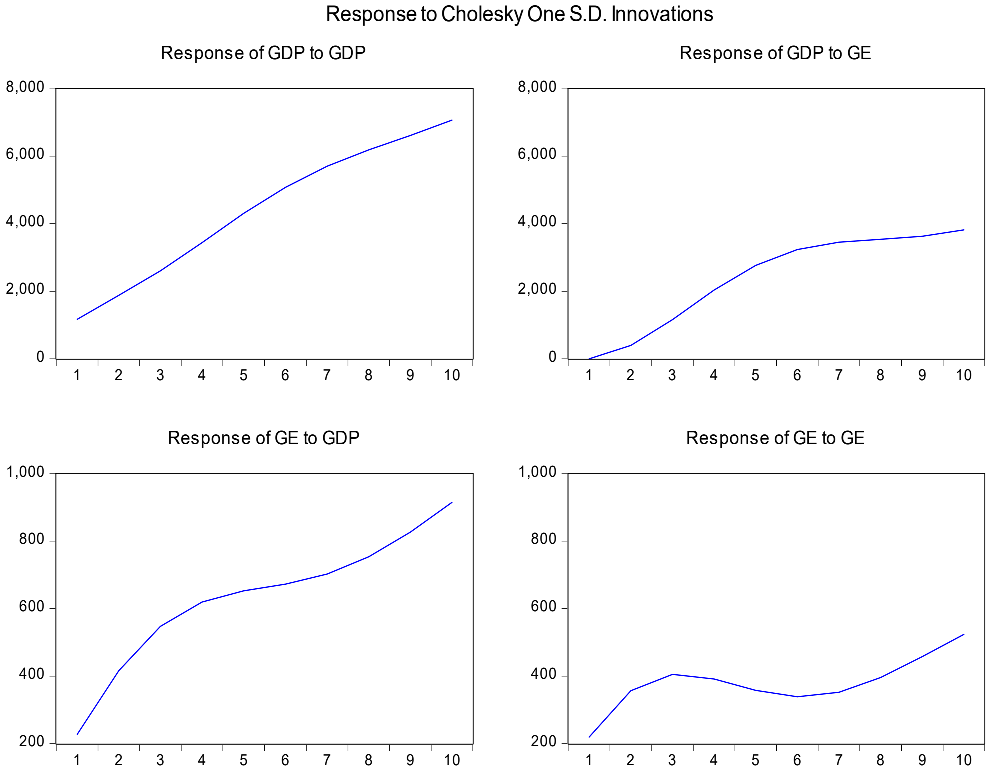
Null Hypotheses	Observations	F-statistic	Prob.	Decision
GE does not Granger Cause GDP	23	3.64210	0.0470	Reject H_o
GDP does not Granger Cause GE	23	0.69695	0.5111	Accept H_o

The results of Granger causality test, as presented in Table-5, show the existence of causality between GDP and government expenditure. The test has the evidence for the presence of unidirectional causality running from government expenditure to GDP. This means that the value after government spending can help us to expect the value for the next period of GDP. As the F-statistic of null hypothesis: GE does not Granger Cause GDP- is statistically significant, the hypothesis is rejected to infer that government expenditure does Granger cause GDP in India. While, the other hypothesis that GDP does not Granger Cause GE- is accepted. The Granger causality result validates the findings of VAR and finds evidence to accept Keynesian theory and reject Wagner’s law.

Findings of Granger causality indicate the direction of flow of relationship between the GDP and the government spending, but it does not explain either the nature of relationship or size of response of one variable for the shocks in the other. To meet this requirement, impulse response function is applied. The Figure explains the responsiveness of the endogenous variable in the system to shocks to each of the other endogenous variables. So, for each endogenous variable in the system, a unit shock is applied to the error, and the effects over time are noted. The Figure provides sufficient evidences to understand that future values of GDP respond significantly and positively to the shocks of government spending steadily in the long run. It confirms the findings of VAR and causality test that increasing government expenditure expands economic growth of India. Impulse response function has also explored a very surprising and astonishing result. It is found that a unit shock administered to the current economic growth, the future values of government expenditure respond positively and significantly. The positive sharp upward slowing curve of GE to the response of GDP indicates that the size of public sector increases as the level of economic growth rises with the time. This supports Wagner’s law. It is pertinent to note that neither VAR model nor Granger causality explored such direction of relationship.

Figure

Impulse Response of GDP to GE and GE to GDP



Vector auto regression estimated the nature and size of impact of one variable on the other, Granger causality showed the direction of flow of relations among the variables and the impulse response function measured the response of one endogenous variable for the shocks of the other endogenous variable over the time. None of these techniques factor indicated how much variability in one variable is caused by its own shocks and how much variation is caused by shocks in the other endogenous variable. Variance decomposition technique decomposes such variability factors in the endogenous variables and provide such analysis for a longer period. The results are presented in Table 6.

The results of variance decomposition reflect how much variance of GDP is due to own shocks and how much changes are because of shocks in government expenditure over the period of time. It also helps in ascertaining the variability in government expenditure for the shocks in government expenditure itself and also for the shocks in GDP. From the results it appears that about 25 percent of variability in GDP is owing to the shocks of government expenditure in the time horizon. Though the size of variability in GDP for the shocks in government expenditure is not substantial, but still it has a significant impact. This result is in conformity with the findings of impulse response function, Granger causality and VAR supporting Keynesian theory.

Variance decomposition of government expenditure shows that in India 74 percent of variability is explained by the lagged values of GDP. This validates the finding of impulse response function which traced out that the size government spending responds significantly to the level of economic growth. This is an evidence of applicability of Wagner's law to the economically progressing Indian economy.

Table 6

Variance Decomposition of GDP and Government Expenditure

Variance Decomposition of GDP			
Period	S.E	GDP	GE
1	1167.612	100.0000	0.000000
2	2246.227	96.87613	3.123873
3	3626.290	88.58476	11.41524
4	5394.769	80.63256	19.36744
5	7435.465	75.95508	24.04492
6	9567.521	74.06288	25.93712
7	11659.85	73.78051	26.21949
8	13666.18	74.21689	25.78311
9	15610.38	74.83996	25.16004
10	17555.49	75.37843	24.62157
Variance Decomposition of GE			
Period	S.E	GDP	GE
1	315.3900	51.74766	48.25234
2	632.0569	56.17105	43.82895
3	928.5065	60.69663	39.30337
4	1182.636	64.83633	35.16367
5	1397.148	68.25907	31.74093
6	1587.148	70.84892	29.15108
7	1770.889	72.63559	27.36441
8	1964.743	73.71349	26.28651
9	2180.045	74.24393	25.75607
10	2421.406	74.45435	25.54565

Thus, from the result of variance decomposition it appears that the forecasting error in economic growth is significantly explained by the lagged values of government spending and the forecasting error in the size of government spending is significantly explained by the lagged values of the level of economic growth.

Conclusion and Policy Implications

A revisit to the nexus between economic growth and government spending in India has led to the inference that each of the variables is influenced positively by the other endogenous variable. This implies that as the government spending increases, the future economic growth of the country is also expected to rise. It validates Keynes' growth theory who argued that owing to multiplier effect, government spending accelerates economic growth in the long run. The government expenditure triggers several economic activities across the country and creates employment opportunities in different sectors over the time. The size of multiplier differs depending upon the sector of spending. As revealed by some of the earlier studies infrastructure expenditure, capital spending and spending on human resource may have large multiplier effect.

The findings of the study, interestingly, also has the evidence to support Wagner's law. The impulse response function and variance decomposition techniques brought out that as the level of economic growth of the country increases in terms of GDP, the size of public sector reflecting in government expenditure also rises. This trend could be attributed to the need to meet growing needs of the people with the growth of the economy. As the economy grows in terms of urbanisation, industrialisation etc. government ought to spend more toward safety and security, civic facilities, technological upgrading, modern tools and equipment in all sectors and levels, etc.

The results of the study, hence has significant policy implications. Economic growth and government spending are interrelated. The government has to pursue a fiscal policy focusing on its spending. Again the government spending may be directed toward sectors like infrastructure and social sector like health, education etc. which are expected to have a large multiplier effect. High growth generated by large government spending in turn will further spur up government expenditure. Hence a circular flow between government expenditure and economic growth could be established. Effective fiscal planning and efficient allocation and administration of the government funds will be the lynch pin of growth.

The findings of Gangal and Gupta (2013) support Keynesian theory whereas the study of Srinivasan (2013) validates Wagner's law in Indian case. But hardly past studies could establish mutual relationship with empirical validation. As an improvement over earlier studies, this paper establishes mutual positive relationship among economic growth and government spending. Hence the findings of this study contributes to the empirical literature with a new perspective to future research discussions and also to design effective policy framework.

The future studies may adopt disaggregated approach to government spending to ascertain accurately what kind of expenditure has more impact on the growth. Efforts can also be made to measure the size of multiplier of government spending in different sectors.

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Annex

Log Values of GDP and Government Expenditure
(1991-1992 to 2015-2016)

Year	Log GDP	Log GE
1991-1992	8.81563	7.015838
1992-1993	8.954861	7.111659
1993-1994	9.095328	7.257376
1994-1995	9.254922	7.382367
1995-1996	9.414688	7.485912
1996-1997	9.560488	7.605925
1997-1998	9.66294	7.749551
1998-1999	9.800002	7.935015
1999-2000	9.914986	7.999856
2000-2001	9.988478	8.08823
2001-2002	10.06724	8.195085
2002-2003	10.14106	8.326633
2003-2004	10.25467	8.457874
2004-2005	10.3866	8.513691
2005-2006	10.51688	8.528604
2006-2007	10.66772	8.671436
2007-2008	10.81719	8.871605
2008-2009	10.93846	9.086992
2009-2010	11.07873	9.234532
2010-2011	11.26243	9.390433
2011-2012	11.40864	9.476057
2012-2013	11.52419	9.554194
2013-2014	11.64	9.654672
2014-2015	11.73075	9.719368
2015-2016	11.82593	9.789978

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