Causal Relationship between Government Spending and Economic Growth in Rajasthan : A Toda - Yamamoto Approach

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Abstract

This paper examined the causal link between state government expenditure and net state domestic product of Rajasthan. The study tested the six versions of the Wagner law of state expenditure utilizing the annual time-series data of 44 years from 1970-71 to 2013-2014. The ARDL Model and Toda-Yamamoto approach were applied after testing the stochastic properties of the variables to analyze the long-run equilibrium relationship for all the six versions of the Wagner Law. The empirical results of the ARDL model asserted that there was no long-run relationship between public expenditure and economic growth. However, the results of the Toda-Yamamoto approach indicated that Peacock and Guffman versions were valid for Rajasthan. The findings of the causality analysis revealed that there was unidirectional causality from state government expenditure to net state domestic product and from state government expenditure to per-capita net state domestic product. The study concluded that the Rajasthan economy follows the Keynesian hypothesis of public expenditure and the public expenditure is the causal factor for the growth of net state domestic product in the state.

Keywords : Wagner's law, public expenditure, net state domestic product, causality, ARDL model, and Toda-Yamamoto approach

JEL Classification : C22, E62, H50

Paper Submission Date : October 5, 2015 ; Paper sent back for Revision : November 9, 2016 ; Paper Acceptance Date : January 9, 2017

After the second World War, the share of public expenditure in total gross domestic product has been continuously increasing in all the countries. Wagner law and Keynesian hypothesis are the two celebrated theories which explain the functional relationship between public expenditure and economic growth. Wagner hypothesis considers economic growth as determinants of public expenditure, while the Keynesian hypothesis considered public expenditure as a determinant of economic growth. In Wagnerian law, public spending is treated as an endogenous variable. In contrast to it, Keynesian hypothesis considers it as an exogenous variable. Mathematically speaking, Wagner's law suggests the direction of the causality from economic growth to public expenditure, and in case of Keynesian hypothesis, it is from public expenditure to economic growth. The direction of the causality is the most important factor for policy implication. If the direction of the causality is from economic growth to public expenditure, then the economic growth variables should be treated as an important policy variable in the policy framework.

The relationship between public expenditure and economic growth has been widely discussed in economic

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literature since 1960. While some studies are based on cross sectional analysis (Abizadeb & Gray, 1985 ; Al-Faris, 2002 ; Chen & Lin, 2004), others are based on time series analysis (Ansari, Gordon, & Akuamoah, 1997). It should be noted that cross section studies could not capture the dynamic link between the variables. According to Henrekson (1993), a test of Wagner law must be based on the time series analysis of public expenditure in a country for as long as possible. In this context, some studies simply use the Ordinary Least Squares (OLS) technique to analyze the impact of public expenditure on economic growth, whereas others are based on advanced time series techniques. The results of these studies also vary from country to country and from one time period to other. Some studies found the existence of Wagner law in few countries, while others found the evidence in favour of Keynesian hypothesis. Moreover, some studies also found unidirectional causality between the two variables, and still others found bi-directional causality. Thus, the results of empirical testing of Wagner's law are varied, compelling, and inconclusive.

This inconclusive evidence motivated us to examine the empirical validity of both, the Wagner's law and Keynesian hypothesis for the state of Rajasthan in India. The debate is still not settled and further studies are required to compare the validity of both hypotheses. The relationship between public expenditure and economic growth is a complicated one and requires sophisticated econometric techniques to investigate their inter-relationship. In the Indian context, there are some studies which have tested the validity of Wagner law (Bhat, Nirmala & Kamaiah, 1991 ; Singh & Sahni, 1984; Srinivasan, 2013; Verma & Arora, 2010). We ,therefore, analyze the relationship between public expenditure and economic growth for Rajasthan.

Review of Literature

According to Wagner, with an increase in economic growth, government activities also increase, causing public expenditure to inflate. This is also known as the law of increasing state activities in economic literature or the Wagner's law of state activities. According to Wagner, there are various reasons for the increase in public expenditure such as industrialization, increase in social security, increasing demand of public services like education, cultural activities, welfare expenditure, health services etc. In other words, the income elasticity of these activities is greater than one.

The important point of Wagner law is the unidirectional causal relationship between public expenditure and national income, with causality running from national income to public expenditure. On the opposite side, the Keynesian hypothesis postulates the unidirectional causality from public expenditure to national income.

In economic literature there are a number of research studies based on the dynamic causal link between public expenditure and economic growth, but the results of these studies are mixed. With regard to causality, the results of these studies are devoid of any consensus. In some cases, these studies found unidirectional causality, and in other cases, they suggested bi-directional causality between public expenditure and economic growth. For example, Gupta (1967) analyzed the Wagner law for four developing countries and found that these countries followed the Wagner law of public expenditure ; while Abizadeh and Gray (1985) concluded that the Wagner law is not valid for poor countries and it is only applicable for rich economies. Ram (1986) investigated the validity of Wagner law for 63 countries and found that there was no causality between the two variables. Jackson, Fethi, and Fethi (1999) also made an attempt to analyze the causal link between public expenditure and economic growth for North Cyprus from 1977 to 1996. The result of the empirical analysis indicated that the Keynesian hypothesis is valid for Cyprus economy.

Bagdigen and Cetintas (2003) analyzed the Turkish economy to test the validity of Wagner's law with the annual time series data from 1965 to 2000 and found no causality in either direction. In a nutshell, neither Wagner's Law nor Keynes hypothesis was valid in the Turkish case. Barua (2005) analyzed the long run relationship between revenue and expenditure causality in Bangladesh using annual time series data from 1974 to 2004. The empirical results of the study suggested the direction of the causality in favour of Wagner's law.

Sakthivel and Yadav (2007) found the bi-directional causality between government spending and economic growth in India. Olugbenga and Owoye (2007) observed the unidirectional causality in 16 countries out of 30 OECD countries from 1970 to 2005. Ansari, Gordon, and Akuamoah (1997) tested Wagner's law for South Africa, Ghana, and Kenya. They found the inferences in favour of the Wagner's law. Liu and Hsu (2008) analyzed the U.S. data from 1947 to 2002 and found that there was unidirectional causality from government expenditure to national income. Thus, Keynesian hypothesis was validated for the world's largest economy. Kalman and Aziz (2009) analyzed Wagner law for Bangladesh and found the evidence in favour of Wagner's law. Rehman, Iqbal, and Siddiqi (2010) applied the Toda Yamamota approach to analyze the causality between public expenditure and economic growth for Pakistan economy from 1971 to 2006. The study suggested one way causality from gross state domestic product to government expenditure.

Yilgör, Erttrugrul, and Celepcioglu (2012) studied the effect of public expenditure on economic growth in Turkey from 1980 to 2010. The results showed that there was a one-way causal relationship from current, transfer, and total expenditures to economic growth in Turkey. Using the error correction model, Srinivasan (2013) studied the relationship between state expenditure and growth in India. The period of the study was 1973 to 2012. The empirical results indicated that one-way causality runs from economic growth to public expenditure in the short-run and long-run, supporting Wagner's law of public expenditure.

Abu-Eideh (2015) examined the causal relationship between public expenditure and GDP growth in Palestine during the period between 1994 and 2013. The results revealed that there was a long-run relationship between public expenditure and GDP growth. It was also found that public expenditure and GDP have a cause and effect relationship with each other. Al-Fawwaz (2016) investigated the causal relationship between public expenditure and growth in Jordon during the period 1980 to 2013. The application of OLS model showed that there was a positive impact for both total government expenditure and current government expenditure on economic growth. A study of the impact of public expenditure on economic growth in Nigeria revealed that capital expenditure had a significant effect on the growth and development of Nigeria economy. Further, total expenditure also had a positive impact on the growth of Nigerian economy. The results of the study are not reliable due to the OLS estimation technique applied in the study (Ojong, Nkamare, and Anthony, 2016).

Afonso and Alves (2016) tested the validity of Wagner's Law for 14 European countries for the period 1996 to 2013. They adopted advanced econometric technique of panel data and SUR method. Wagner's Law was validated for four (Austria, France, the Netherlands, and Portugal) out of 14 countries while for others it was rejected.

From the foregoing analysis, it is clear that the empirical evidences regarding the validity of Wagner's law are mixed, and results vary from country to country. The results also vary by the econometric treatment of the problem. Hence, it becomes interesting to examine whether the results for the economy of Rajasthan support Wagner's law or not.

Overview of Rajasthan Economy

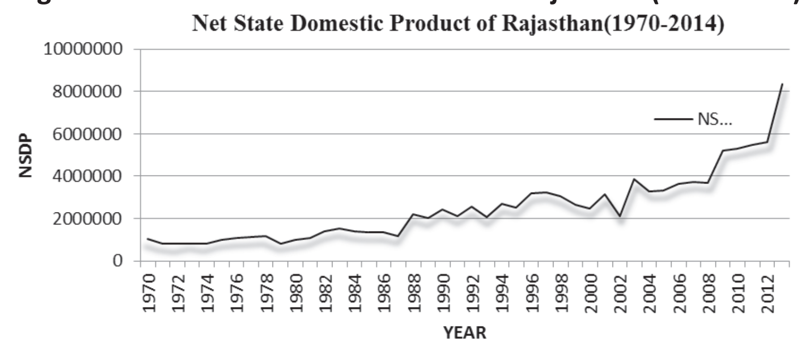
Rajasthan is the largest state in India geographically. 60% of the state is desert, and the remaining 40% area is hilly. Although the state has sufficient minerals resources, it severely lacks water recourses. The state accounts for only 1% of the total water resources available in the country. Due to lack of water, the state frequently faces problems of famines and droughts which have significant impact on the state's finances. A large share of the state's finances goes for relief operations every year. In this situation, the state government has to maintain adequate financial resources for the welfare and development of the state. The growth rate of the state is also affected by other unfavorable conditions as the economy is mainly based on agriculture and related activities. The net state domestic product (NSDP) of the state was ₹ 58,972 lakhs in 1958-59 at current prices, and ₹ 46,507 lakhs at constant prices of 1954-55. In 1980-81, the NSDP at factor cost was ₹ 4,96,403 lakh with a per capita income of

₹ 572 at constant prices of 1970-71. The NSDP of the state was ₹ 24,000 crore in 1994-95.

The percentage growth rate of the NSDP was 5.53 in 2010-11. Figure 1 shows the NSDP of Rajasthan for the period 1970-2014 (Directorate of Economics and Statistics, 2014). Rajasthan was one of the fastest growing states among all the Indian states with 7.43% annual growth rate of gross state domestic product during the period 2005 to 2011 and the per capita income of the state was ₹ 39967 in 2011, whereas in absolute terms, the state domestic product was continuously increasing and had positive trend with some fluctuations.

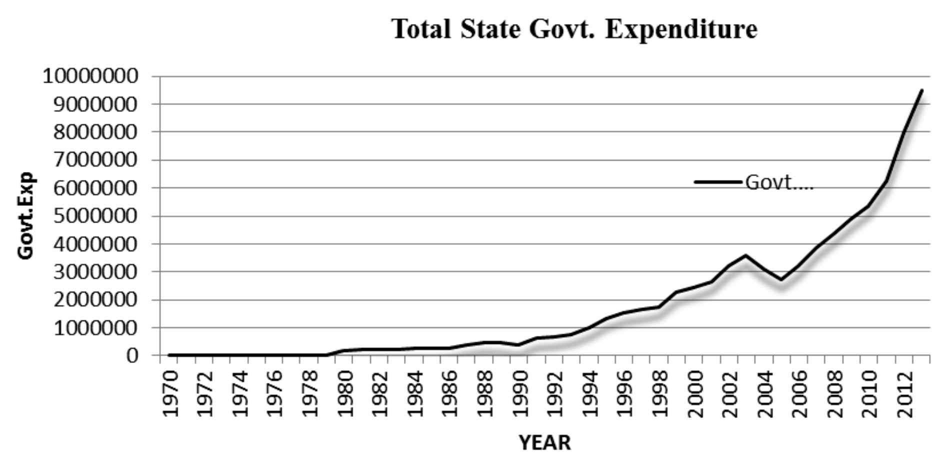
The total government expenditure of the state was ₹ 24,770 lakh in 1970 and with a 19% increase it was ₹ 151009 lakh in 1980-81. The total expenditure of the state was ₹ 60524.46 crore in 2011-12. The states expenditure has been continuously increasing in both total as well as per capita terms. Figure 2 shows that there is upward trend in total expenditure of the state government. The total government expenditure has increased exponentially since 2010.

Figure 1. Net State Domestic Product of Rajasthan (1970-2014)



Source: Author's compilation on the basis of data collected from various issues of Statistical Abstracts of Rajasthan.

Figure 2. Total Government Spending in Rajasthan (1970 - 2012)



Data and Methodology

This study utilized secondary data pertaining to public finance of Rajasthan government. The data related to government expenditure and net state domestic product was collected from Statistical Abstract of Rajasthan, published by the Department of Economic and Statistics of the Rajasthan government. The study period was from 1970 to 2014. Thus, this study was based on time series statistics as suggested by different researchers.

Wagner's law contains six versions for empirical analysis by different economists with different mathematical functional forms. The present study analyzed all the versions of Wagner's law for the Rajasthan economy. Specifically, the following hypothesized relationships were tested :

(i) Peacock Version : $\mathrm{L}G = a + b\,\mathrm{L}(GDP)$

(ii) Guffman Version : $\mathrm{L}G = a + b\,\mathrm{L}(GDP/N)$

(iii) Pryor Version : $\mathrm{L}GCE = a + b\,\mathrm{L}GDP$

(iv) Musgrave Version : $\mathrm{L}(G/GDP) = a + b\,\mathrm{L}(GDP/N)$

(v) Gupta Version : $\mathrm{L}(G/N) = a + b\,\mathrm{L}(GDP/N)$

(vi) Mann Version : $\mathrm{L}(G/GDP) = a + b\,\mathrm{L}GDP$

where, G = government expenditure, GDP = gross state domestic product, GCE = government consumption expenditure, N = total population.

(1) Unit Root Test : In order to avoid the problem of spurious relationship in time series analysis, the study used the Augmented Dickey Fuller Test (ADF) and the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test to test the stationary properties of each time series. Both the tests are based on three different forms of regression analysis. The model specification is same for all the versions, except for the change in the independent variable and dependent variable. The estimated regression equation for the unit root tests are followings :

With Drift

$$\Delta \ln GEXP = \beta_0 + \beta_3 \ln GEXP_{t\text{-}1} + \Sigma_{i=1}^{i=m} \alpha_i \, \Delta \ln GEXPP_{t\text{-}i} + \varepsilon_t \quad \ldots\ldots (1)$$

With Drift and Trend

$$\Delta \ln GEXP = \beta_0 + \beta_2 t + \beta_3 \ln GEXP_{t\text{-}1} + \Sigma_{i=1}^{i=m} \alpha_i \, \Delta \ln GEXP_{t\text{-}i} + \varepsilon_t \quad \ldots\ldots (2)$$

Without Drift and Trend

$$\ln GEXP = \beta_3 \ln GEXP_{t-1} + \Sigma_{i=1}^{i=m} \alpha_i \, \Delta \ln GEXP_{t\text{-}i} + \varepsilon_t \quad \ldots\ldots (3)$$

In the above equations, β is coefficient of proceeding observation, $\Delta \ln GEXP_{t\text{-}i}$ is difference lag term, m is the number of lags, α_i is the parameter to be determined, ε_t is the disturbance term. In all the three equations of ADF test, the null hypothesis is that $\beta_3 = 0$ (has unit root or stationary) and the alternative hypothesis is that the $\beta_3 \neq 0$ (no unit root or stationary). If the null hypothesis is rejected, then the series will be stationary and said to be integrated of order zero (I0).

In case β_3 is found to be negative and statistically significant from zero, then the computed τ-statistics of the parameter is compared with the critical tabulated value of Mackinnon, Haug, and Michelis (1999). If the variable is found to be non-stationary at level, then the same procedure is applied on the first difference of the variable, and the following regression equation is estimated :

$$\Delta^2 \ln GEXP = \beta_0 + \beta_2 t + \beta_3 \ln GEXP_{t-1} + \Sigma_{i=1}^{i=m} \alpha_i \, \Delta^2 \ln GEXP_{t-i} + \varepsilon_t \quad \ldots\ldots (4)$$

If the variables are non-stationary at level, but stationary at first-difference form, then the variables are said to be 1(1). The null hypothesis for the KPSS test states that the variable under the analysis has no unit root or the variable is stationary. In KPSS Test, the acceptance of the null hypothesis states that the variables have no unit root problem, which is the inverse of the null hypothesis of the ADF Test.

(2) Leg Length Selection Criterion : To select the optimum leg length for the analysis, the study used the Akaike information criterion (AIC) and the Schwarz information criterion (SIC). The minimum value of AIC and SIC is taken for the selection of optimal leg length of the models. The study used the FPE (final prediction error), AIC (Akaike information criterion), SIC (Schwarz information criterion), HQ (Hannan-Quinn information criterion), and LR (likelihood ratio) test for optimum leg length selection in the Toda Yamamoto Model.

(3) Autoregressive Distributed Lag Model (Bound test) for Co-integration : We employed the autoregressive distributed leg model proposed by Pesaran, Shin, and Smith (2001) to analyze co-integration between economic growth (net state domestic product) and state government expenditure. The purpose of the co-integration is to investigate the long-run relationship between both the variables under study. Some empirical studies have indicated that the ARDL approach of co-integration is more suitable than the other co-integration approaches such as Engle and Granger (1987) and Johansen and Juselius (1994). The ARDL test has a non-standard distribution, and the main advantage of this test is that it can be applied in cases even when the two series are integrated of different order, that is, one is $I(0)$ and another is $I(1)$ or $I(2)$ (Odhiambo, 2009). In addition, it also avoids the pre-testing procedure of standard co-integration analysis (the classification of the variables into $I(1)$ and $I(0)$) and also provides more robust estimation when the sample size is small (Narayan, 2005).

The co-integration under ARDL Model identifies the long run relationship between the variables by comparing the upper and lower bound values and the computed *F*- statistics for testing the significance of the lagged levels of the variables in the error correction. The null hypothesis under the ARDL Model is that there is no long run relationship between the variables under testing procedure. If the computed *F*-statistics exceed the upper bound value, the null hypothesis of no long run association can be rejected to conclude that there is long run relationship between the variables. If the calculated *F*-statistics is below the lower bound value, the null hypothesis of no co-integration cannot be rejected. The results of the ARDL Model will be inconclusive if the calculated *F*-statistics lies between the set of upper and lower bound values of Pesaran table. The ARDL also estimates the error correction term. It provides information about the speed of adjustment towards equilibrium in the model. The error correction term should be negative, less than 1 and highly significant, which is an evidence of the existence of a stable long-term relationship (Bannerjee, Dolado, & Mestre, 1998).

(4) Econometric Specifications : The present study estimated the following bi-variate models of bound testing procedure for possible long run relationship between both the variables of the study.

$$\Delta \ln GEXP_t = \alpha_0 + \sum_{i=1}^{n} \phi_j \Delta \ln GEXP_{t-i} + \sum_{i=1}^{n} \omega \Delta \ln NSDP_{t-i} + \delta_1 \ln GEXP_{t-i} + \delta_2 \ln NSDP_{t-1} + \varepsilon_{1t} \quad \ldots\ldots (5)$$

$$\Delta \ln NSDP_t = \alpha_0 + \sum_{i=1}^{n} \beta \Delta \ln NSDP_{t-i} + \sum_{i=1}^{n} \sigma \Delta \ln GEXP_{t-i} + \eta_1 \ln NSDP_{t-i} + \eta_2 \ln GEXP_{t-1} + \mu_{1t} \quad \ldots\ldots (6)$$

In the above models, *ln GEXP* is the log value of state government expenditure; *ln NSDP* is the log value of net state domestic product, Δ is the difference operator and μ_{1t} and ε_{1t} are the disturbance terms. Both the equations test the joint significance of the lagged value of the variables with *F* - statistics (Wald test). Here the null hypothesis is H_0: $\eta_1 = \eta_2 = 0$ in equation (10) and $H_0 = \delta_1 = \delta_2 = 0$ in equation (11) (or null hypothesis is that there is no co-integration between the variables). If the null hypothesis is rejected, then the empirical analysis has the evidence of the existence of long run relationship between both the variables.

The next step is to estimate the ARDL Model with the selection of the order of the ARDL (n,m) using the AIC criteria. The following model ARDL will be estimated :

$$\ln GEXP = \alpha_0 + \sum_{i=1}^{n} \psi_1 \Delta \ln GEXP_{t-1} + \sum_{i=1}^{n} \psi_2 \Delta \ln NSDP_{t-1} + \varepsilon_t \qquad \ldots\ldots (7)$$

Then in the final step of the bound test, an error correction model (ECM) has been estimated in order to find the short run dynamic parameters. In this step, the lagged values of the variables will be replaced with the error correction term to estimate the speed of the adjustment of the dependent variable to independent variables.

The following equation is to be estimated to find the short run relation between the variables :

$$\Delta \ln GEXP_t = \gamma + \sum_{i=1}^{n} \Gamma_i \Delta \ln GEXP_{t-i} + \sum_{i=1}^{n} \Omega_i \Delta \ln NSDP_{t-i} + \Phi ECM_{t-1} + \varepsilon_t \qquad \ldots\ldots (8)$$

Here, Γ_i and Ω_i are the short run dynamic coefficient and Φ is the speed of adjustment and ECM is the error correction term. If the value of Φ is equal to zero, then there is no long run relationship between the variables, and if the value of Φ lies between -1 to 0, then there is partial adjustment. Moreover, if the value of the speed of the adjustment is less than -1, then it will be the evidence of the over adjusted model in the current period. On the contrary, a positive value of the speed of the adjustment will mean that the system will be moved away from the equilibrium in the long run.

(5) Toda Yamamoto Approach : Toda and Yamamoto approach (1995) is an alternative approach to the Granger causality approach and involves testing for Granger non-causality in level vector auto-Regressive (VARs), irrespective of whether a series is $I(0)$, $I(1)$ or $I(2)$, non co-integrated or co-integrated. The Toda Yamamoto approach is augmented with extra leg estimation by the order of integration of the series. It employs a modified Wald test with the restriction on parameters of the *VAR (k)* (k is the leg length of the VAR model). The test has an asymptotic chi square distribution with k degrees of freedom, order in the limit when a VAR ($k + dmax$) is estimated. Three steps are involved in the estimation of Toda and Yamamoto causality procedure. The first step is to test maximum order of iteration *(d max)* of all the time series variables by utilizing the test like ADF test, Phillips- Perron (PP) test, and the KPSS. The second step of the Toda Yamamoto approach is to determine the optimal leg length *(p)*, by the use of various lag length criterion like the AIC, SIC, final prediction error (FPE), and Hannan Quinn Criterion. The final step of this procedure involves the modified Wald procedure to test the VAR *(k)* model for causality where optimal leg length is equal to $k = (p + dmax)$.

The present study formulates the Toda-Yamamoto test of Granger causality as follows :

$$\Delta \ln GEXP_t = \phi_1 + \sum_{i=1}^{k} \beta_{1i} \ln GE_{t-i} + \sum_{j=k+1}^{d\max} \beta_{2i} \ln GEXP_{t-j} + \sum_{i=1}^{k} \Pi_{1i} \ln NSDP_{t-j} + \sum_{j=k+1}^{d\max} \Pi_{2i} \ln NSDP_{t-j} + \varepsilon_{2t} \qquad \ldots\ldots (9)$$

$$\Delta \ln NSDP_t = \phi_0 + \sum_{i=1}^{k} \alpha_{1i} \ln NSDP_{t-i} + \sum_{j=k+1}^{d\max} \alpha_{2i} \ln NSDP_{t-j} + \sum_{i=1}^{k} \gamma_{1i} \ln GEXP_{t-i} + \sum_{j=k+1}^{d\max} \gamma_{2i} \ln GEXP_{t-j} + \varepsilon_{1t} \qquad \ldots\ldots (10)$$

where, k is the optimal lag length; *dmax* is the maximum order of integration, ε_{1t} and ε_{2t} are white noise error terms with zero mean, constant variance, and no autocorrelation. The causality from government expenditure to net state domestic product is tested by examining the null hypothesis that *lnNSDP* does not cause *lnGEXP*. $H_0: \Pi_{1i} = 0$ $\forall i$ in equation 9. Similarly, in equation 10, the hull hypothesis is $H_0 : \gamma_{1i} = 0 \ \forall i$.

If the analysis rejects the null hypothesis of equation 5 and accepts the null hypothesis of equation 4, it will lead to the conclusion that changes in *lnGEXP* are Granger caused by the change in *lnNSDP* ; and if one of the hypothesis (either hypothesis of equation 4 or hypothesis of equation 5 is rejected), then it shows the unidirectional causality between both the variables. Moreover, if there is indication of the rejection of both the null hypotheses (equation 4 and 5) then it signifies the bidirectional causality between both the variables.

Empirical Results

(1) Results of Stationary Tests : The Table 1 shows the results of ADF Test for the unit root properties of all the variables under study. It is clear that the government consumption expenditure and total government expenditure *(lnGCE* and *lnGEXP)* are the two variables which have unit root problem at level. But after the first difference, both the variables become stationary. Other variables such as per capita expenditure *(lnGEXPPC)*, net state domestic product *(lnNSDP)*, per capita net state domestic product *(lnNSDPPC)*, and the share of government expenditure to net state domestic product *(ln(GEXP/NSDP)* are stationary at level or integrated of order zero.

The KPSS test of unit root shows the same decision for the unit root properties of the variables as given by the ADF test (Table 2). The study employs the KPSS test only for the cross verification of the order of the integration of the variables as the null hypothesis of both the tests are inverse to each other.

Table 3 reports the results of Bound Test for co-integration between the variables. The results clearly indicate that there is no co-integration between the variables in any of the six versions of Wagner's Law for the state of Rajasthan.

Table 4 presents the results of the Toda-Yamamoto test for non-causality. The result reveals that the first version of the Wagner Law (Peacock Version) has the unidirectional causality between net state domestic product and state government expenditure of Rajasthan.

The results are also identical for the second version (Guffman version) where unidirectional causality exists between per capita nets state domestic product and government expenditure and the direction of the causality is from government expenditure to net state domestic product. The results of the Toda-Yamamoto Approach for the

Table 1. Results of Unit Root Test (ADF Test)

Variables	Level		First Difference		Order of Integration
	C*	C&T**	C	C&T	
	ADF Stat	ADF Stat	ADF Stat	ADF Stat	
lnGCE	-1.766 (0.3915)	-1.357 (0.8592)	-5.956 (0.000)	-6.414 (0.000)	I(1)
lnGEXP	-0.767 (0.8180)	-1.953 (0.6091)	-6.110 (0.0000)*	-6.137 (0.000)*	I (1)
lnGEXPPC	-0.294 (0.9753)	-4.925 (0.0013)*	-10.651 (0.0000)*	-10.670 (.000)*	I(0)
lnNSDP	-0.436 (0.9823)	-4.804 (0.0019)*	-10.671 (0.0000)*	-10.733 (0.000)*	I(0)
lnNSDPPC	-0.243 (0.9722)	-4.958 (0.0012)*	-10.638 (0.0000)*	-10.642 (0.000)*	I(0)
Ln(GEXP/NSDP)	-0.192 (0.9689)	-4.984 (0.0011)*	-10.621 (0.0000)*	-10.612 (0.000)*	I(0)

Table 2. Results of Unit root Test (KPSS Test)

Variables	Level		First Difference		Order of Integration
	C	C&T	C	C&T	
	KPSS Stat	KPSS Stat	KPSS Stat	KPSS Stat	
lnGCE	0.8232 (0.4630)	0.1998 (0.1460)	0.3219 (0.4630)*	0.1084 (0.1460)*	I(1)
LnGEXP	0.83650 (0.4630)	0.1699 (0.1460)	0.1259 (0.4663)	0.1065 (0.1460)	I(1)
LnGEXPPC	0.8312 (0.4630)	0.0738 (0.1460)	0.4604 (0.4663)	0.4118 (0.1460)	I(0)
LnNSDP	0.8319 (0.4630)	0.0756 (0.1460)	0.4634 (0.4663)	0.41036 (0.1460)	I(0)
LnNSDPPC	0.8309 (0.4630)	0.0743 (0.1460)	0.4583 (0.4663)	0.4119 (0.1460)	I(0)
Ln(GEXP/NSDP)	0.8305 (0.4630)	0.0754 (0.1460)	0.4511 (0.4663)	0.4043 (0.1460)	I(0)

Table 3. Results of Bound Test

Version's of Wagner's Law	Variable Pairs	Optimal Lag Length	*F* - Statistics	Decision
1	LnGEXP, LnNSDP	2	1.9833	No Co-integration
2	LnGEXP, LnNSDPPC	2	1.3560	No Co-integration
3	LnGCE, LnNSDP	2	3.4692	No Co-integration
4	Ln(GEXP/NSDP), LnNSDPPC	2	3.3016	No Co-integration
5	LnGEXPPC, LnNSDPPC	2	1.3556	No Co-integration
6	Ln(GEXP/NSDP), LnNSDP	2	2.0776	No Co-integration

Table. Pesaran Critical Values*-

Critical Values	*K*=2	*I*(0)**	*I*(1)***
	10 %	4.19	5.06
	5%	4.87	5.85
	2.5%	5.49	6.59
	1 %	6.34	7.52

(*)Pesaran Critical Values With Unrestricted Intercept and Unrestricted Trend Table No Ci(V) Case (V) : Unrestricted Intercept And Unrestricted Trend, (**) Lower Bound Value, (***) Upper Bound Value

Table 4. Results of Toda-Yamamoto Approach

Versions of Wagner's Law	Causes and Effects	Test-stat*	Values	DF	Prob.
1	LnNSDP $\Rightarrow$ LnGEXP	Chi-sq	16.8622	4	0.3521
	LnGEXP $\Rightarrow$ LnNSDP	Chi-sq	13.4852	4	0.0091
2	LnNSDPPC $\Rightarrow$ LnGEXP	Chi-sq	14.5294	4	0.9158
	LnGEXP $\Rightarrow$ LnNSDPPC	Chi-sq	15.9648	4	0.0031
3	LnGCE $\Rightarrow$ LnNSDP	Chi-sq	10.1460	4	0.8065
	LnNSDP $\Rightarrow$ LnGCE	Chi-sq	14.2530	4	0.3180
4	LnNSDP $\Rightarrow$ Ln(GEXP/NSDP)	Chi-sq	11.3971	4	0.5224
	Ln(GEXP/NSDP) $\Rightarrow$ LnNSDP	Chi-sq	13.4852	4	0.4991
5	LnNSDPPC $\Rightarrow$ LnGEXPPC	Chi-sq	17.1392	4	0.3918
	LnGEXPPC $\Rightarrow$ LnNSDPPC	Chi-sq	13.3227	4	0.7898
6	LnNSDP $\Rightarrow$ Ln(GEXP/NSDP)	Chi-sq	14.6842	4	0.7854
	Ln(GEXP/NSDP) $\Rightarrow$ LnNSDP	Chi-sq	15.8461	4	0.6332

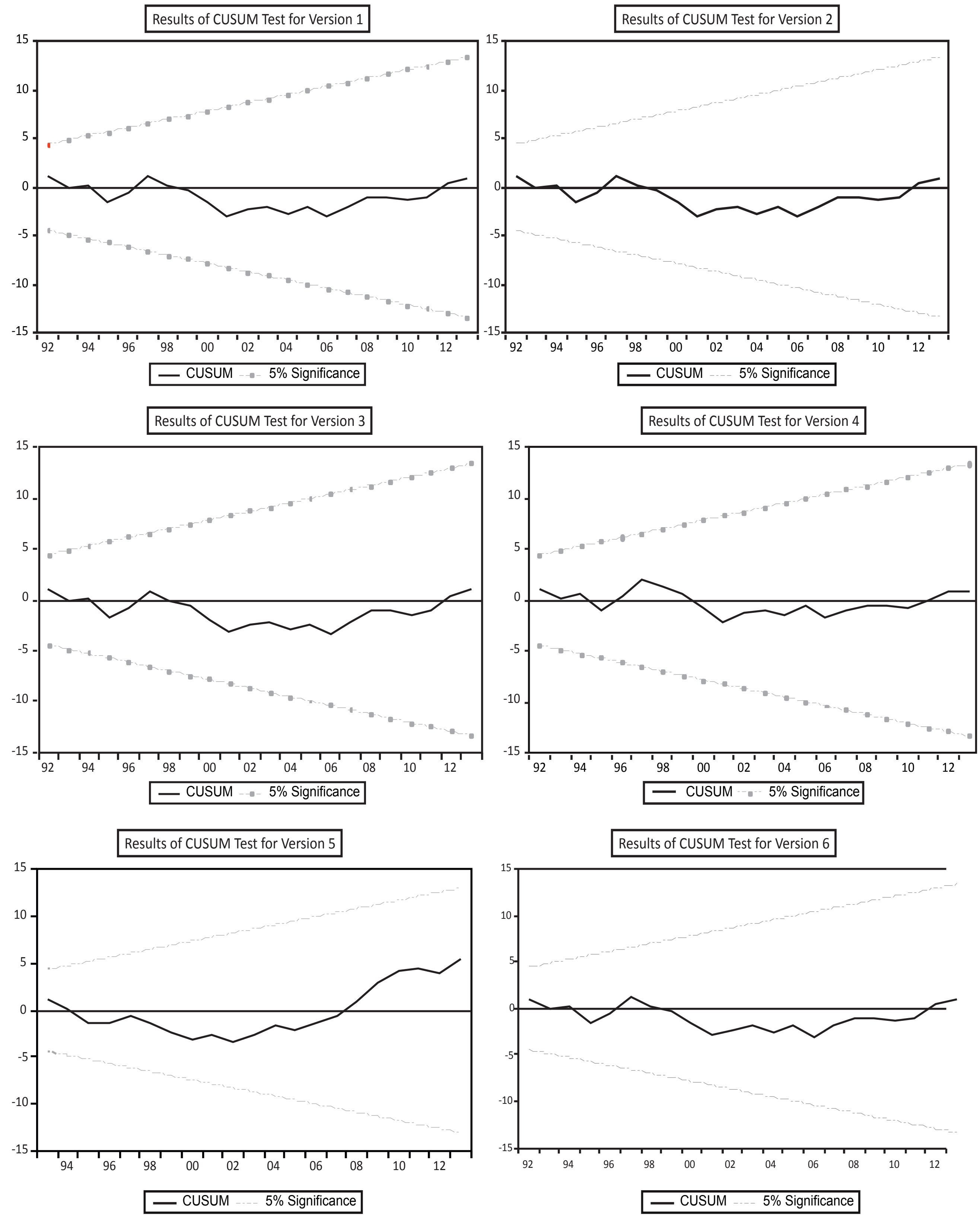
(*)Modified Wald test chi-square statistics to test whether the *k* lags are equal to zero or not.

Table 5. Results of Diagnostic Tests

Versions	Normality Test		BPG Test		Serial Correlation LM Test	
	JB Stat.	*P* - value	Obs* R^2	*P*-value	Obs* R^2	*P*-value
1	3.8762	0.1439	7.9240	0.3393	3.0560	0.2170
2	2.2574	0.3234	5.4396	0.4888	0.9133	0.6334
3	7.2666	0.2642	7.6776	0.2627	2.0141	0.3653
4	7.1862	0.2751	7.6539	0.2646	2.1306	0.3446
5	6.8259	0.0322*	6.5436	0.3947	3.2627	0.1957
6	15.0747	0.0005*	8.3902	0.2540	6.3319	0.1757

(*) Represents the rejection of null hypothesis.

Figure 3. Results of Stability Test (CUSUM Test)



other versions of Wagner's law like Pryor, Musgrave, Gupta and Mann are not valid for the economy of Rajasthan. The results of the diagnostic checking of the ARDL Model are presented in Table 5. The results of the diagnostic tests revealed that all the versions satisfied all the tests for an efficient model, except the fifth and sixth versions. The fifth and sixth versions had the normality problem and the null hypothesis was rejected in both the cases.

(2) Results of Stability Test (CUSUM Test) : The results of the stability test for all the six models are shown in Figure 3. The results showed that all the models met the stability condition i.e. all the models were stable and had no stability problems.

Research and Policy Implications

The study examined the causal link between government spending and economic growth for the state of Rajasthan by investigating the empirical validity of Wagner's law. With the use of annual time series data from 1970-71 to 2013-14, the study tested the relationship between state government spending and net state domestic product for all the six versions of Wagner's Law. The study utilized the ADF and KPSS tests to test stationary properties of the variables in the study and autoregressive distributed leg model (ARDL model) to test the long run equilibrium relationship (co-integration) between the variables. The study also employed the Toda-Yamamoto approach to investigate the causality between government expenditure and net state domestic product in Rajasthan. The empirical analysis of the study indicated that there was no co-integration between both the variables in all the six versions of Wagner law. Thus, the necessary condition for the validity of Wagner's law was not satisfied. The findings of the Toda-Yamamoto Approach indicated that only two versions (Peacock and Guffman Version) were valid for Rajasthan economy out of six versions of Wagner's law. Thus, out of the six hypotheses, only two of them (first two were accepted). However, both the hypotheses contain different causality relationship. Hence, it can be concluded that weak evidence was found for the validity of Wagner's law in the case of Rajasthan.

The empirical analysis of the study inferred that the direction of the causality is from state government expenditure to net state domestic product in case of Peacock version and from state government expenditure to per capita net state domestic product in case of Guffman version in Rajasthan. As the causality is from the state government expenditure to net state domestic product, it is clear that the Rajasthan economy follows the Keynesian hypothesis of public expenditure, which states that the direction of the causality from government expenditure to national income. The study concluded that the Keynesian Hypothesis is valid for the Rajasthan economy.

The findings of the study have several important policy implications. First, the study suggests that state government should focus more on public expenditure rather than net state domestic product as the public spending of the state is the causal factor of economic growth. The significant role of the state in promoting development even after two decades of economic reforms is an interesting finding. The study urges the policy makers to step up public expenditure especially capital expenditure to boost growth rate in the long run. For instance, government should pay attention to infrastructure development and other measures to accelerate the pace of development.

Second important implication is for financial discipline. Financial discipline tends to weaken the validity of the law. Given the high inflationary pressure in the Indian economy, state governments should try to balance fiscal discipline with public expenditure, especially capital expenditure.

Limitations of the Study and Scope for Further Research

Few important limitations of the study are worth mentioning which provide scope for further studies in this area.

The first limitations pertain to the time period used in this study. The lack of long run relationship between public expenditure and economic growth might be due to the short time frame used in the study. Hence, future studies can be undertaken for longer time period. Further, research also needs to be undertaken for other states to have better information about the causal link between public expenditure and economic growth in the Indian context. Second, the composition of total public expenditure is also an important factor in determining the economic growth. But this study provides no evidence regarding it. Hence, researchers can examine the inter-relationship between the composition of public expenditure and economic growth. Last but not the least, the study also suffers from certain methodological limitations. Hence, further studies can benefit from panel estimation approach to examine the dynamic long run relationship between public expenditure and economic growth for deeper insights into the operation of Wagner law in India and proper policy formulation.

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