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AN EMPIRICAL VERIFICATION OF WAGNER HYPOTHESIS IN HARYANA (INDIA) : AN ARDL BOUNDS TESTING APPROACH

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This study attempts to examine the validity of Wagner Hypothesis with alternative versions during the time period of 1980 to 2014 in the state of Haryana (India). The long run association between economic growth and government expenditure is examined by using Auto Regressive Distributed Lag model and the causalality relationship has been investigated using Granger Causality Test. The results of ARDL model exhibited weak evidence of Wagner Hypothesis during studied period. The results of Granger Causality test indicate that unidirectional causality exists from economic growth to government expenditure.

Keywords: *Economic growth, government expenditure, unit root, ARDL and granger causality.*

INTRODUCTION

Investigating the association between government expenditure and state income become an important issue especially in developing state where a larger portion of economic resources are used by the government to create employment opportunities and speed up economic development. The share of government expenditure rises at a rate greater than that of national income in developing countries during the pace of development (Wagner, 1883).

A striking feature Haryana economy from 1980s is the rapid growth of public sector. The relative share of government expenditure in the net state domestic product (NSDP) was 20.03 percent in 1980; 19.58 percent in 1990; 17.11 percent in 2000, with a peak of 120.07 percent in 2006-07 and then reduced to 34.99 percent in 2013-14(Study of State finances, RBI, Various Issues).As the net state domestic product of the any state increases over a period of time, the share of government expenditure relative to income will increase and particular behaviour of government expenditure has been popularly known as Wagner's law, coined by Adolf Wagner in 1883.Growing of economic growth and its relationship with government expenditure has attracted the attention of economists, researchers and policy makers from time to time, however, increasing state level activities has captured wide attention among researchers and economist during the last three decades. Wagner's hypothesis focuses on the relationship between economic growth and the degree of government expenditure and postulates that the latter grows at a faster rate than the former over the period of time to meet the rapid demand of industrialisation, social welfare and development in the economy. Wagner hypothesis has attracted wide attention in public finance literature (Gupta 1967, Musgrave, 1969; Peacock-Wiseman,1979; Mann, 1980).To check the validity of Wagner's Law, numerous studies have been conducted thereafter in different countries and supported the objective of Wagner law (Wagner & Weber, 1977; Oxley, 1994; Chang, Liu, & Caudill, 2004; Akitoby, et. al., 2006; Narayan, et. al., 2012; Tsaurai & Odhiambo, 2013;Atasoy & Gür, 2016; Keho, 20161833-1938, this paper attempts, for the first time, to analyze the causal relationship between income and government

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spending in the Greek economy for such a long period; that is, to gain some insight into Wagner and Keynesian hypotheses. The time period of the analysis represents a period of growth, industrialization ,and modernization of the economy, conditions which are conducive to Wagner's Law but also to the Keynesian Hypothesis. The empirical analysis resorts to autoregressive distributed lag (ARDL), however, many have provided results against to Wagner law(Magazzino, Giolli, & Mele, 2015; Moore, 2016).

Government expenditure enhanced private sector productivity in one hand and on the other hand it may crowed out some private investment, moreover, economic growth has affected positively by government expenditure if government expenditure is complementing to private sector without any reduction of private expenditure (Alesina et al., 2002).A striking feature of Haryana state economy over last four decades particularly in the 21 century is to increase in the size of government sector through admirable growth of state income. The average Government expenditure as the percentage of NSDP was around 22 percent in the decade 1980-90; 21.98 percent during 1990-00 and with a drastic change i.e. 48.66 percent in the time span of 2000-14, while the compound annual growth rate of the State economy (measured by NSDP) was 12.58 percent in the 1980s, 15.89 percent in the 1990s and 14.74 percent in the period 2000-14(Study of State finances, RBI, Various Issues). The average fiscal deficit as percentage of NSDP has decreased during the studied period, which is a good symbol for State economy if this is reduce without compromising development and social activities of the state's.

Theoretical Framework of Wagner Law

The value of elasticity of government expenditure with respect to output provides the validity of Wagner Hypothesis. As with many hypotheses that are also propounded in general forms, many functional forms of Wagner law have been specified. However, many studies across the world have empirically tested the Wagner's law and have given conflicting results that varies from country to country. This study addressed five of these alternative interpretations i.e. Peacock and Wiseman (1961), Peacock and Wiseman share (1961), Gupta (1967), Goffman (1968), Musgrave (1969).

Peacock-Wiseman model advocated that the elasticity of government expenditure with respect to national income should be greater than unity whereas Peacock- Wiseman model described that elasticity of share of government expenditure in total national income should be greater than zero. Musgrave proposed value of elasticity between share of government expenditure in total output and per capital income should be greater than zero. According to Gupta (1967) government expenditure (per capita) is a function of per capita income. Other specification of Wagner law postulated by Goffman (1968) explains that the responsiveness of government expenditure with per capita income should be greater than one.

The literature on testing the Wagner hypothesis is explained in a very rich manner. Several empirical studies have been conducted in developed as well as in developing countries across the world. Wagner and Weber (1977) investigated empirically the growth of government activities in 34 nations during post war period. The study suggested that Wagner Law is a random occurrence which has an equal chance of happening or not happening. However, in nineties many studies used advanced econometric methods such as panel data analysis, granger causality model, co-integration analysis and auto regressive distributive lag (ARDL) model to get rid the problem of spurious regression.

Chang et al., (2004) empirically examined the validity of Wagner's Law for ten countries during the time period of 1951-1996 and reveal the one way causality from Gross Domestic Product to

government expenditure in the newly industrialised countries i.e. South Korea and Taiwan while there was supporting results of Wagner hypothesis in the countries of US and UK. However, no support of Wagner hypothesis was instituted in Australia, South Africa and Thailand. Ansari, Gordon& Akuamoah (1997) tested the Wagner versus Keynes law in Ghana, Kenya and South Africa and confirm Wagner law for Ghanawhile there was no evidence of Keynes and Wagner hypothesis for Kenya. However, there was unidirectional causality from government expenditure to total output which supports the Keynesian hypothesis in South Africa. Atasoy and Gür (2016) tested the Wagner hypothesis for China over the period of 1982-2011and the results of ARDL bound test indicates that 1 % rise in national income will results in greater than unity i.e. 1.63 % rise in government expenditure, confirm the validity of Wagner's Law for China.

Akitoby et al., (2006)tested the co integration between government expenditure and gross national income in 51 developing countries and only 70 percent of the studied countries supported the Wagner law. Karagianni, Pempetzoglou& Strikou (2002) examined the six alternative versions of Wagner's hypothesis inEuropeonUnion-15 countries using the period of 1949-1998.The results argued that investigation the validity of Wagner law is very much supportive to methods used.

There are many studies that could not found evidence in favour of Wagner law**.** There was evidence against Wagner law in Ireland as the ratio of Government expenditure with respect to national income is not greater than unity(Moore, 2016).Abizadeh and Gray(1985) found the validity of Wagner law only for developing countries (not for poor countries) and government spending decreased with growth in aggregate income.

Empirical Researches in India

Singh et al. (1984) investigated the causality between total public expenditure and national income along with different components of government expenditure over the time period 1950 to 1981 in India and confirmed the bi-directional causality between government expenditure and GDP i.e. GDP causes government expenditure (Wagner's Hypothesis) and government expenditure causes GDP (Keynesian view). Mohsin *et al.* (1992)tested the causal association between government expenditure and aggregate income over the time period 1950-51 to 1988-89 in India using co-integration, Granger Causality test and Error Correction Modeling and provided strong evidence of one way causal relationship moving from government expenditure to aggregate income in real and nominal terms.

Khundrakpam (2003) examined the Wagner Law in India between 1960-61 to 1996-97 by using the autoregressive distributed lag model and found evidence in favour of Wagner hypothesis. Verma and Arora (2010) using annual data during the period 1950-2007 in India, provided the positive evidence for the Wagner hypothesis in long run. Narayan et al. (2012) examined the effectiveness of Wagner's law for 15 different states of India with the help of panel co-integration technique and provide evidence regarding long run association between government expenditure and state income. Bansal &Shardha (2012) using cross section data for 29 Indian states found that the elasticity of public expenditure is lower than the economic growth which reveals the absence of validity of Wagner's Law. There is bi-directional causality existed between public expenditure and economic growth (Gangal& Gupta, 2013).

Ranjan and Chintu (2013) checked the validity of Wagner's law in India during 1970–71 to 2010–11. The results of the study confirmed that economic growth and size of government of government expenditure are co-integrated with each other. Further, results confirmed thecausal relationship

from economic growth to government expenditure, which verified the existence of Wagner's law in India. Adil et al.(2017) empirically tested the long run relationship between government expenditure and national output by covering the period from 1970-2013 in India. The results of ARDL model provide weak evidence of Wagner's Law in India but found long run relationship between GDP and government expenditures. On the basis of existing literature we can say that there is mixed evidences regarding Wagner's Hypothesis.

The following table 1. reveals the decade wise trends in growth rate of NSDP, average government expenditure and fiscal deficit as percentage to NSDP of the state of Haryana.

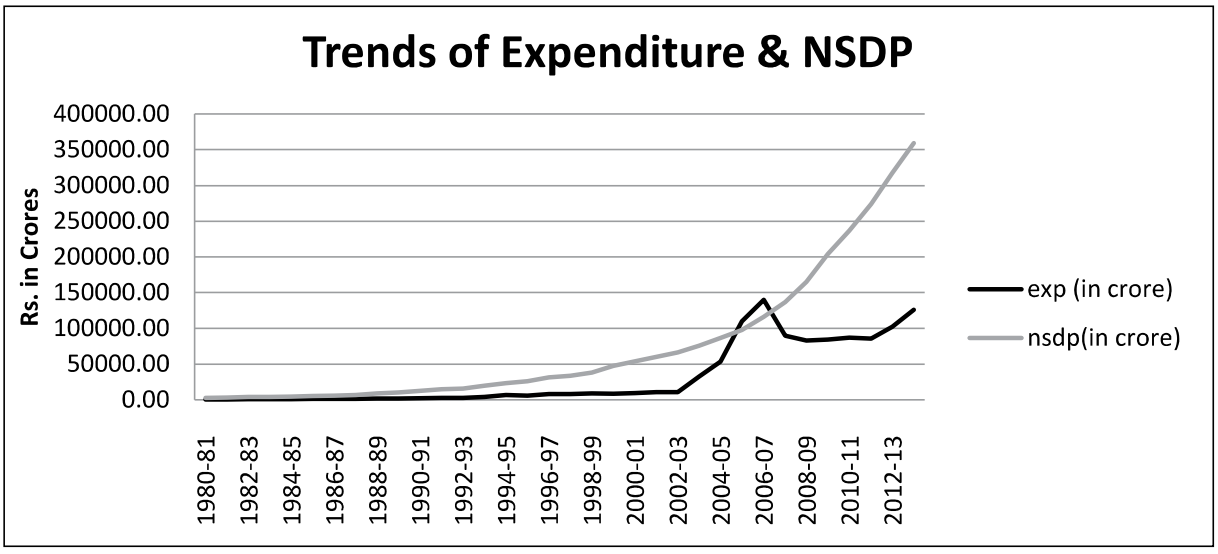
Table 1. Specific Trend in Government Expenditure, Growth Rate and Fiscal Deficit of Haryana

Decade Wise Analysis	CAGR of NSDP	Average Govt. exp. (% of NSDP)	Average Fiscal Deficit (% of NSDP)
1980	12.58	22.32	3.65
1990	15.89	21.98	3.45
2000-14	14.74	48.66	2.49

Source: RBI, Study of State finances and handbook of statistics of Indian economy (various issues).

The average share of government expenditure in total NSDP was around 22.32 percent in 1980-90, slightly reduced to 21.98 percent in 1990-00. However, again it showed increasing trend more than double from last decade i.e., 48.66 percent during the period of 2000-14.

Figure 1. Trend and Pattern of State Income (NSDP) and Government Expenditure (1980-2014)



The above trend and pattern shows the increasing phenomenon of government expenditure and NSDP with the development pace of Haryana state. However, it is particularly imperative to check the elasticity of government expenditure with respect to increase in economic growth.

The purpose of examining the Wagner law for a long time is mainly because industrialisation brings social progress and justice, and this requires increased government participation in economic and

social activities of the society in any state. The government expenditure have increased faster than national income during the phase of industrialization in many countries across the world (Atasoy & Gür, 2016).

DATABASE AND METHODOLOGY

Data Sources

Annual time series data from 1980 to 2014 is used for testing the validity of Wagner hypothesis. Total Government expenditure (GE) is used as a proxy of size of public sector whereas NSDP (Y) is used to measure the economic performance. All the data used in the study is taken from study of state finances (various issues) issued by Reserve Bank of India. All the data has been transformed in natural logarithm. The relationship is expressed through the below specification:

$$GE=f(Y) \quad (1)$$

Where GE represents the size of the government and Y indicates the economic growth i.e., NSDP.

ARDL model is used to investigate the validity of Wagner Hypothesis. Unlike Engle and Granger (1987) and Johansen & Juselius (1990), ARDL technique can be applied irrespective of whether regress or in the model is I(0) or I(1). However, it is necessary to check the stationary of the variables because ARDL cannot be used in the presence of I (2). In this study, Augmented Dickey Fuller (ADF) test, Phillip Perron (PP) test and Dickey Fuller-GLS test of unit root are used to check whether data are stationary at I(0) or I(1). Further, ARDL bounds test based on the joint significance of F-statistic is used to find out co-integration between the competing variables. If resulted value of calculated F-statistic is higher than critical value of upper bound (bound test), at that time we will reject the null hypothesis of no co-integration variables are co-integrated and vice-versa.

Wagner Law using ARDL Model

In order to examine the validity of Wagner's Hypothesis, five functional specifications- extensively cited in literature of Wagner's Law, has been used. The appealing aspects of various versions of Wagner hypothesis to test the long run relationship between size of the state government expenditure and national income are specified as follows:

1. Peacock- Wiseman version

$$\Delta Log(GE)_t = \alpha_0 + \sum_{i=1}^{p} \alpha_1 \Delta Log(GE)_{t-i} + \sum_{i=0}^{p} \alpha_2 \Delta Log(Y)_{t-i} + \pi_1 Log(GE)_{t-1} + \pi_2 Log(Y)_{t-1} + \mu_t \quad \text{..... (2)}$$

Where

GE - government expenditure of the state, Y is the Net state domestic product, α_1, α_2 short run elasticity and π_1, π_2 shows long run elasticises. In this version, the value of coefficient of Y should be greater than unity i.e. $\pi_2 > 1$.

2. Peacock-Wiseman share version

$$\Delta Log\left(\frac{GE}{Y}\right)_t = \beta_0 + \sum_{i=1}^{p} \beta_1 \Delta Log\left(\frac{GE}{Y}\right)_{t-i} + \sum_{i=0}^{p} \beta_2 \Delta Log Y_{t-i} + \kappa_1 Log\left(\frac{GE}{Y}\right)_{t-1} + \kappa_2 Log Y_{t-1} + \mu_t \quad \text{... (3)}$$

Where

$\frac{GE}{Y}$ proportion of government expenditure in state income, Y denotes the Net state domestic product, β_1, β_2 short run estimator and κ_1, κ_2 shows long run elasticities. According to Peacock-Wiseman version, the value of coefficient of Y i.e. κ_2 should be greater than 0.

3. Musgrave Version

$$\Delta Log\left(\frac{GE}{Y}\right)_t = \chi_0 + \sum_{i=1}^{p} \chi_1 \Delta Log\left(\frac{GE}{Y}\right)_{t-i} + \sum_{i=0}^{p} \chi_2 \Delta Log\left(\frac{Y}{N}\right)_{t-i} + \phi_1 Log\left(\frac{GE}{Y}\right)_{t-1} + \phi_2 Log\left(\frac{Y}{N}\right)_{t-1} + \mu_t \quad \text{..... (4)}$$

χ_1, χ_2 short run estimator and ϕ_1, ϕ_2 shows long run elasticities and according to this version, the value of coefficient of $\frac{Y}{N}$ i.e. ϕ_2 should be greater than 0.

4. Gupta Version

$$\Delta Log\left(\frac{GE}{N}\right)_t = \partial_0 + \sum_{i=1}^{p} \partial_1 \Delta Log\left(\frac{GE}{N}\right)_{t-i} + \sum_{i=0}^{p} \partial_2 \Delta Log\left(\frac{Y}{N}\right)_{t-i} + \sigma_1 Log\left(\frac{GE}{N}\right)_{t-1} + \sigma_2 Log\left(\frac{Y}{N}\right)_{t-1} + \mu_t \quad \text{..... (5)}$$

Where Y/N – per capita net state domestic product, ∂_1, ∂_2 - short run estimator and σ_1, σ_2 shows long run elasticities and according to this version, the value of coefficient of $\frac{Y}{N}$ i.e. σ_2 should be greater than Unity.

5. Goffman Version

$$\Delta LogGE_t = \psi_0 + \sum_{i=1}^{p} \psi_1 \Delta LogGE_{t-i} + \sum_{i=0}^{p} \psi_2 \Delta Log\left(\frac{Y}{N}\right)_{t-i} + \omega_1 LogGE_{t-1} + \omega_2 Log\left(\frac{Y}{N}\right)_{t-1} + \mu_t \quad \text{..... (6)}$$

Where

ψ_1, ψ_2 short run and ω_1, ω_2 are long run dynamics and according to this version, the value of ω_2 should be greater than Unity.

RESULTS AND DISCUSSIONS

The present paper is unique in nature as for the first time; the validity of Wagner hypothesis is tested during the time period from 1980-81 to 2013-14 in Haryana (India). After 1991 economic reform, Haryana is driven by high growth rate in urbanisation, industrialisation and attracted the large amount of FDI. Wagner Law also implies that during industrialization, the share of government activities in the economy would increase at a rate greater than that of national income.

The ARDL bound test should be applied when data is integrated at level or at first difference and stationarity test will confirms the variables are not integrated at order two I(2). As proposed by Pearson et.al.(2001), if the variables are stationary at I(2),ARDL bound test can't be used. The results of Augmented Dickey Fuller (ADF) test, Phillip Perron (PP) and DF-GLS Test for examining the stationarity of data are presented in Table 2.

The ADF test, PP and DF-GLS test were carried out by including an intercept without trend in the

specified equation. All the competing variables are found non-stationary at level but turned into stationary by taking first difference which is confirmed by the all the tests of unit root reported in table 2.

Table 2. Stationarity-Unit Root Test

	ADF		PP		DF-GLS	
	Level	**First Difference**	**Level**	**First Difference**	**Level**	**First Difference**
Log GE	0.4425	4.4343***	0.4856	4.4343***	0.1662	4.5057***
Log Y	0.197	3.1846**	0.7774	6.6644***	0.1997	1.9493*
Log GE/Y	2.121	4.1806***	1.9169	4.1806***	2.0531**	4.2491***
Log Y/N	0.9313	6.5337***	1.2246	6.5337***	0.1556	1.7465*
Log GE/N	0.4395	4.4334***	0.4946	4.4334***	0.5061	4.5039***

Source: Authors' own calculations.

*,**,*** shows significance level at 10%, 5% and 1% respectively.

The stationarity test of these variables confirmed that the variables are not I(2) and we can apply the ARDL model to investigate co integration among variable. By using ARDL model, we can estimates the relationship among variables in terms of elasticity. The results of ARDL model are given in the Table 3. The value of F statistics exceeds the upper bound critical values at 5 percent level of significance in Peacock Wiseman share and Musgrave versions, while Peacock Wiseman, Gupta and Goffman versions are significant at 10 percent level, hence confirmed co integration among the competing variables. The model also fulfils the entire required diagnostic test and value of R^2 & adjusted R^2 is also very high. Diagnostic test given in table 4 confirms that all these alternative model of Wagner's Law are free from the problem of auto correlation, heteroskedasticity and serial correlation.

Table 3. Long Run Elasticities Estimates of the selected Model

	ARDL Model							
Wagner's Alternative Version	**ARDL**	**Bound Test (F-statistics)**	**Coefficient**	**T-statistics**	**Prob.**	**R^2**	**Adjusted R^2**	**Durbin Watson**
Peacock Wiseman	(2,0)	3.59*	0.3167	2.2236	0.0344	0.9998	0.9777	2.24
Peacock Wiseman share	(3,0)	4.26**	0.0938	2.2687	0.0318	0.8239	0.7969	2.11
Musgrave	(3,0)	4.25**	0.1106	2.2682	0.0319	0.8239	0.7969	2.11
Gupta	(3,0)	3.99*	0.5038	3.1139	0.0045	0.9769	0.9733	2.07
Goffman	(3,0)	4.11*	0.5768	3.1017	0.0046	0.9818	0.979	2.07

Source: Authors' own calculation.

*,**indicates level of significance at 10% and 5% respectively.

Table 4. Diagnostic Test

Wagner's Alternative Version	Serial Correlation LM Test	Heteroskedasticity	Normality Test
	F statistics (P value)	Chi Square (P value)	Jarque- Bera (P value)
Peacock Wiseman version	1.9131 (0.1284	0.6011 (0.5857)	34.22 (0.0000)
Peacock Wiseman share version	0.3574 (0.7129)	1.2395 (0.2909)	9.7191 (0.0077)
Musgrave version	0.3658 (0.7027)	1.1980 (0.3058)	9.9832 (0.0067)
Gupta version	0.1433 (0.9035)	1.1073 (0.3411)	12.193 (0.0022)
Goffman version	0.1480 (0.8994)	1.001 5(0.3835)	14.18 (0.0008)

Source: Authors' own calculation.

Even though, the estimated coefficients of all the specified versions are statistically significant, yet the values of estimated elasticity are not consistent with prediction of alternatives versions of Wagner hypothesis except Peacock-Wiseman share version and Musgrave version. According to Peacock Wiseman version, Gupta version and Goffman version the required sign of coefficient should be greater than one, however, it can be stated that Wagner hypothesis confirms the limited applicability of Wagner's hypothesisin Haryana.

After checking the long run relationship among the variables, we have checked the direction of causality between them with the help of Granger causality test the results are provided in table 5.

Table 5. Granger Causality Test

Granger Causality Variable Pair	lag length (AIC criterion)	F-Statistics	p- value	Causality Direction
Log GE and Log Y	3	4.2655	0.015**	LY →LGE (unidirectional)
Log Y and Log GE		1.4091	0.2645	
Log (GE/Y) and LY	3	1.9938	0.1418	LGEY ≠ LY (No Causality)
Log Y and Log (GE/Y)		1.4091	0.2645	
Log (GE/)Y and Log (Y/N)	3	1.9351	0.1509	LGEY ≠ LYN(No Causality)
Log (Y/N) and Log (GE/Y)		1.5809	0.22	
Log (GE/N) and Log (Y/N)	3	4.0936	0.0176**	LYN→LGEN(unidirectional)
Log (Y/N) and Log (GE/N)		1.5809	0.22	
Log (GE) and Log (Y/N)	3	4.0808	0.0178**	LYN→LGE(unidirectional)
Log (Y/N) and Log (GE)		1.668	0.2004	

Source: Authors' own calculations.
Note: *,**represents significance level at 10% and 5% respectively.

The findings shows that one way causality is running from state economic growth (NSDP) to government expenditure in all versions(except Peacock Wiseman share and Musgrave versions). No causality was found from government expenditure to economic growth in all the alternative version of Wagner's hypothesis. These findings are supported with the alternative specification of Wagner's hypothesis which indicates that as the state income increases over a period of time, the share of government expenditure in national income increases. The elasticity of coefficient in all the versions are greater than zero indicates the limited effectiveness of Wagner's Law in Haryana between a time period of 1980 to 2014.

Coefficient Stability Tests

The coefficient stability of any modelis very crucial and which can be tested by plots of cumulative sum (CUSUM), suggested by Pesaran &Shin (1999) which is given in Figure 2-6.

Straight lines in the graphs indicate critical bounds at 5 % significance level, as the plot of CUSUM and CUSUM square not crossed the critical limit linecofirms a stable long-run association for all the alternative version of Wagner's Law, moreover, it can be concluded that all the coefficients are steady in the long run.

Figure 2. CUSUM Test for Peacock and Wiseman Version

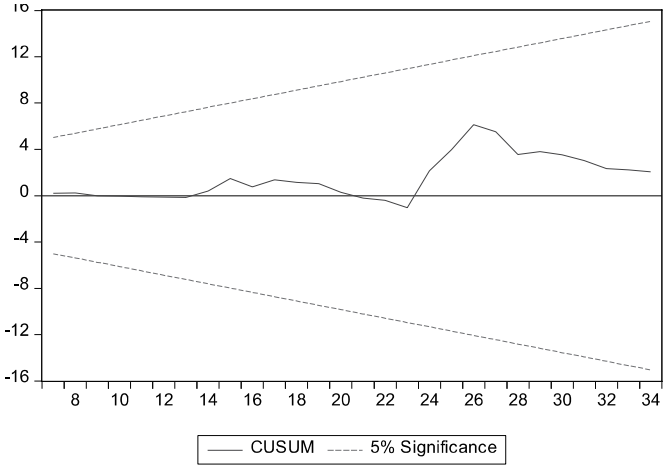


Figure 3. CUSUM Test for Peacock and Wiseman share Version

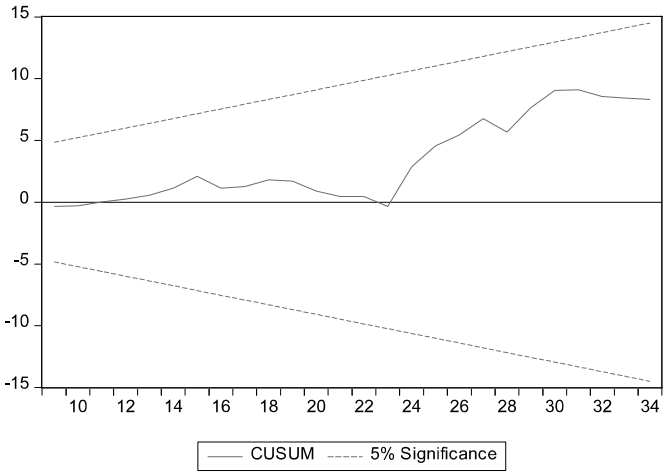


Figure 4. CUSUM Test for Musgrave Version

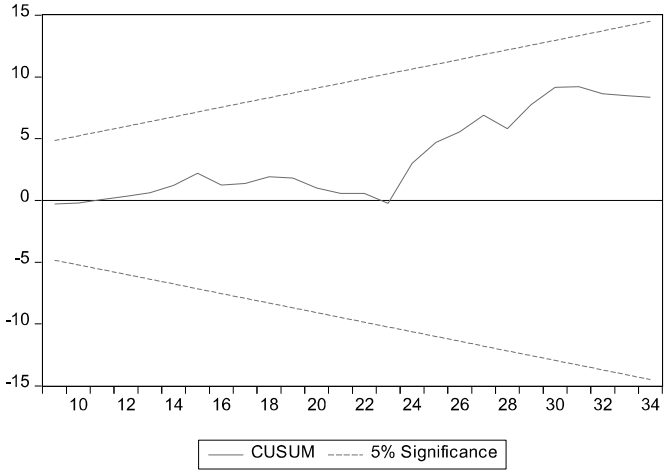


Figure 5. CUSUM Test for Gupta Version

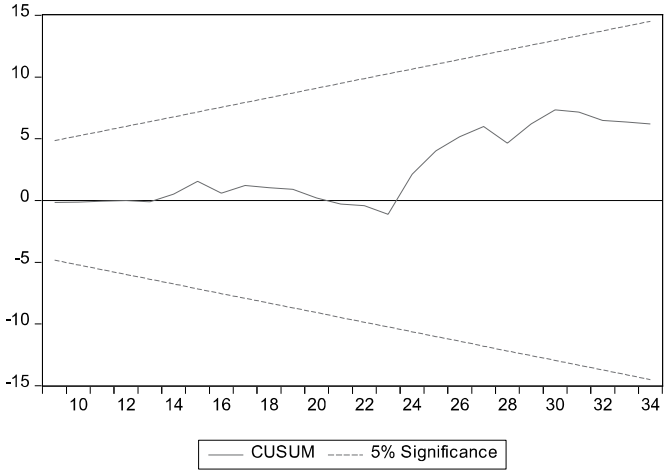
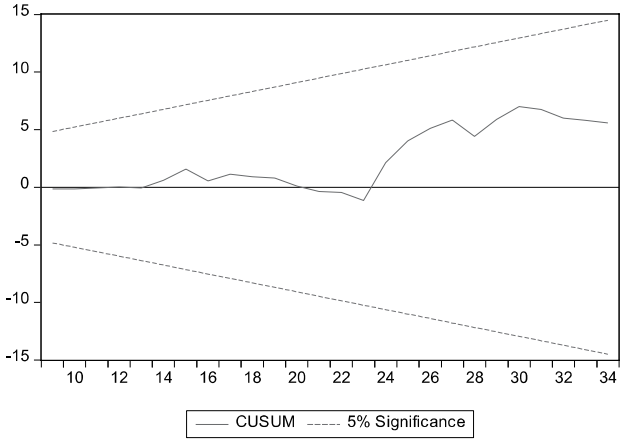


Figure 6. CUSUMTest for Goffman Version



CONCLUSION AND SUGGESTIONS

According to Wagner's law, government expenditure increases faster than income during the pace of development which is a debatable issue in this world at national and state level. To facilitate the impact of industrialisation and modernisation in Haryana (India), we have taken time period (1980-2014) and investigated the five different specification of Wagner law in the state of Haryana. Co integration between government expenditure and economic growth of Haryana (NSDP) has been investigated using ARDL bound test approach. The findings of ARDL bound test suggested that there is co-integration between economic growth and government expenditure in Haryana during studied period. However, government expenditure has been increasing during studied period, but the rate of growth could not exceeded growth in state income. The values of elasticity in Peacock Wiseman share and Musgrave versions are statistically significant. The Granger Causality results confirm the evidence of unidirectional causality moving from economic growth to government expenditure in all the versions (except Peacock Wiseman share and Musgrave version).

Based on the results, the study recommends that increase in public spending in the state of Haryana is a natural process of industrialisation. Rapid economic development in Haryana requires wide improvement in infrastructure along with public transport, health services, education, and welfare schemes. These all will increase the growth of government expenditure; moreover, fiscal policy makers should focus on development expenditure and curtail non-development expenditure to improve fiscal health of the State.

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