A New Proposed Model of Public Expenditure

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Abstract

The present study endeavoured to propose a new mathematical formula based on Wagner's law. Previous six versions of mathematical formulae, stated by different economists, were compared with a new proposed mathematical formula on the basis of three tests - spurious, stationary, and error correction method, taking data of Indian economy. All mathematical formulae, including the proposed one, found that Wagner's law was applicable both in the short as well as in the long run in the Indian economy. However, the proposed model was able to give the highest speed of correcting error in comparison to the other models given earlier. Models given by Peacock-Wiseman (1961), Gupta (1967), Goffman (1968), Musgrave (1969), and Mann (1980) were able to give rate of correcting error less than the model proposed by us. The model given by Pryor (1969) was able to give rate of correcting error more than the model proposed by us, but residuals were not in a stationary state in the Pryor model, while these residuals were in the stationary state in our model. Therefore, the present study found that the proposed model was better in correcting errors in the Indian economy in comparison to other models.

Key words : **Wagner's law, public expenditure, cointegration, ECM, Durbin - Watson, spurious, stationary, ratio test**

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Public expenditure, that is defined as the expenditure incurred by the public authority (that is, Centre, State, and local government) for the collective satisfaction of the citizen of the nations, was treated as wasteful and extravagant in the 17th century. Classical economists supported least government intervention with emphasizing on savings rather than on expenditure in the 18th century. These economists limited the government intervention in areas of justice, arms, and police. A moderate government intervention was supported by Wagner (1883) in the 19th century and he observed that there exists a relationship between economic growth and public expenditure which is known as "Wagner's law of increasing state activities". This law states that the percentage share of public expenditure increases with increase in gross domestic product (GDP). Keynes (1936), in 20th century, in his book, *General Theory of Employment, Interest and Money* emphasized that it is not saving, but it is expenditure, which is required for creating purchasing power among the citizens of the nations for improving social services (i.e. education, health, labour welfare), economic services (i.e. agriculture, industry, energy, minerals, communication), and other non-developmental services. People in the 21st century have started demanding superior health and education (SHE) which further intend to increase public expenditure. It entails that the scope of public expenditure is rising day to day.

Public expenditure may be classified into two broad categories - revenue and capital expenditure. Public

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expenditure incurred on social services, economic services, grants -in -aid, administrative services, and defence is known as revenue expenditure. Expenditure incurred on loans, advances, and discharge of public debts are capital expenditure. This public expenditure differs from private expenditure in terms of motive, income - expenditure relationship, elasticity, involvement of government, and source of financing. Motive of the private expenditure is to earn profit partially or wholly, while the motive of the public sector is to enhance collective satisfaction of the citizens. An arrangement of income is adjusted after deciding magnitude of expenditure in the public authority, while expenditure is adjusted after earnings or income in the private sector. Expenditure elasticity with respect to income is higher in the public sector than it is in the private sector. There is involvement of the government in public expenditure and not in private expenditure. Tax is imposed to meet the public expenditure which is not possible in private expenditure.

Public Expenditure in India

Public expenditure of India consists of both revenue and capital expenditure. The share of revenue expenditure is much more than that of capital expenditure in India as shown in the Table 1. Government consumption

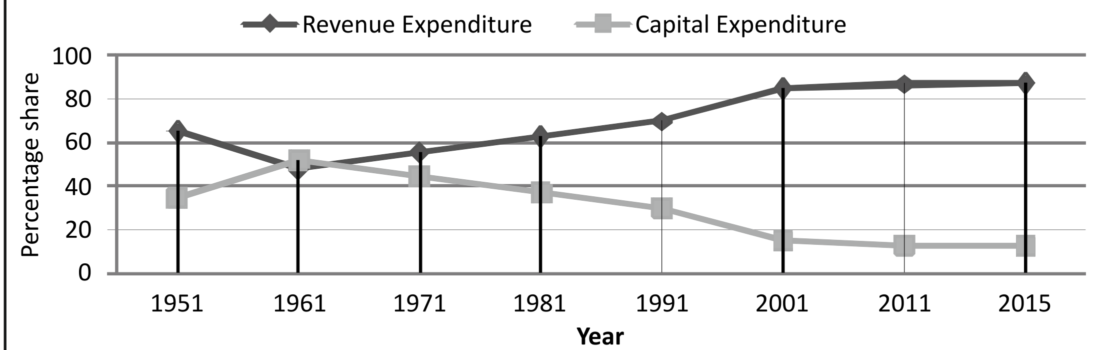
Table 1. GDP, Government Expenditure, Government Consumption Expenditure, and Population of India (₹ Crore)

Year	Revenue Expenditure *(RE)*	Capital Expenditure *(CE)*	Total Expenditure *TE = RE + CE*	GDP	Population# (Cr.) *(P)*	Per Capita NNPFC (₹)	Govt. Consn. expenditure (GCE)#
1950-51	346(65.41)	183(34.59)	529(5.44)	9719	37.10	2697	709.28
1960-61	916(47.78)	1001(52.22)	1917(11.61)	16512	43.40	8889	1649.55
1970-71	3130(55.65)	2494(44.35)	5624(13.08)	42981	54.10	10016	4298.1
1980-81	14410(63.29)	8358(36.71)	22768(17.18)	132520	67.10	10712	13384.52
1990-91	73516(69.81)	31782(30.19)	105298(20.44)	515032	83.90	14330	59743.71
2000-01	277839(85.33)	47753(14.65)	325592(16.91)	1925017	101.90	20418	238702.1
2001-02	301468(83.20)	60842(16.8)	362310(17.27)	2097726	104.10	21093	249629.4
2002-03	338713(81.96)	74535(18.04)	413248(18.27)	2261415	105.60	21578	235187.2
2003-04	362074(76.84)	109129(23.16)	471203(18.56)	2538170	107.20	22985	276660.5
2004-05	384329(77.13)	113923(22.87)	498252(17.31)	2877701	108.90	24143	313669.4
2005-06	439376(86.88)	66362(13.12)	505738(15.41)	3282385	110.60	26015	338085.7
2006-07	514609(88.21)	68778(11.79)	583387(15.44)	3779384	112.20	28067	389276.6
2007-08	594433(83.41)	118238(16.59)	712671(16.49)	4320892	113.80	30332	470977.2
2008-09	793798(89.80)	90158(10.19)	883956(20.01)	4416350	115.40	31754	525545.7
2009-10	911809(89.00)	112678(11.00)	1024487(21.38)	4790847	117.00	33901	546156.6
2010-11	1040723(86.92)	156605(13.08)	1197328(22.66)	5282386	118.60	36342	591627.2
2011-12	1145785(87.84)	158580(12.16)	1304365(23.16)	5633050	120.20	38037	614002.5
2012-13	1243514(88.17)	166858(11.83)	1410372(23.90)	5899847	121.70	39168	666682.7
2013-14	1399540(88.00)	190894(12.00)	1590434(25.67)	6195842	123.30	39904	724913.5
2014-15	1568111(87.36)	226781(12.64)	1794892(28.43)	6312001	125.20	43278	744816.1

Note: Percentage Share in bracket

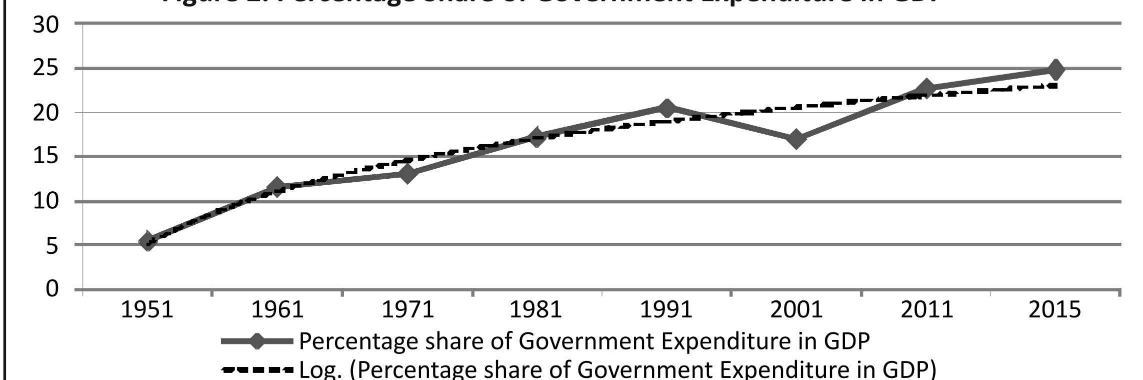
Source: (1) World Bank (#) (2) Reserve Bank of India (2016)

Figure 1. Revenue and Capital Expenditure of India



Source : Reserve Bank of India (2016)

Figure 2. Percentage Share of Government Expenditure in GDP



Source : Reserve Bank of India (2016)

expenditure (GCE) and population data have been taken from International Financial Statistics (IFS). The remaining data were taken from RBI's *Handbook of statistics on Indian economy*. It can be inferred from the Table 1 that revenue expenditure of India has been increasing continuously. It increased from 65.41% of total expenditure in 1951 to 87.36 % in 2015. However, the capital expenditure has been decreasing over the period. It decreased from 34.59% in 1951 to 12.64 % in 2015.

Therefore, the gap between revenue and capital expenditure has been increasing over the period and it is moving against the growth of the Indian economy. It can be inferred from the Figure 1 that the major reason behind the increase in the revenue expenditure of India is rise in the expenditure on defence, subsidies, administrative and grant - in - aid to states. The Figure 2 reveals that the percentage share of government expenditure in GDP of India has been increasing over the period. The rising trend of government expenditure can be attributed to increase mainly in revenue expenditure which accounts for more than 85% of the total expenditure.

Theoretical Exposition

There are various theories stating the reasons of rising public expenditure when an economy develops. Adolph Wagner theory, Allan T. Peacock and Jack Wiseman theory, Colin Clark theory, Samuelson theory, Erik Lindahl theory, Pigou theory, Musgrave and Rostov theory, and Dalton theory are popular among them. Wagner stated that an increase in public expenditure follows a smooth and continuous trend. Peacock - Wiseman said that the increase in public expenditure follows the step trend. Wagner found three reasons for rise in public expenditure - expansion of traditional function, coverage of new functions, and expanding sphere of public goods. Peacock - Wiseman cited three reasons of rise in public expenditure - displacement effect, inspection effect, and concentration effect. Erik - Lindahl gave the critical limit hypothesis according to which he pointed out that in an economy, inflation emerges when the share of taxes and other receipts of the government exceed one - fourth of the public expenditure. Here, the present study limits itself to the Wagner theory.

➭ **Wagner's Law (1835 - 1917) :** Adolf Wagner was a German political economist who propounded an idea in 1883 about the functional cause and effect relationship between growth of an industrializing economy and the relative growth of its public sector. He gave no mathematical formula showing the relationship between economic development and public expenditure. However, in a later phase, some economists developed mathematical formulae showing the relationship between public expenditure and economic development based on Wagner's idea and termed this idea "Wagner's law of increasing state activity". This law states that there exists a positive relationship between public expenditure and economic development. As per capita income and output increases, the public expenditure also increases. When income of the nation rises, activities of central and local governments increase extensively and intensively because they undertake both old and new functions efficiently and completely.

This public expenditure bears continuous increasing smooth trend when the income of a nation rises because of three reasons. First, when income of the nation rises, the expansion of the traditional functions, like defence, administration, justice, law and order, and social overheads become more sophisticated, which increase public expenditure. Second, an increase in real income pushes up the demand for superior health, education, communication, infrastructure, enriched cultural life, social security, and food subsidies, which cannot be provided by the private sector efficiently and completely as can be provided by the public sector. Third, sphere of public goods expand when lumpy investment is required but ignored by public sector like railways, irrigation, flood control, construction and maintenance of public parks, schools, hospitals, and so on.

Wagner also explained factors affecting demand and supply sides of public expenditure as well . First, rise in population and its density affect both the demand for and supply of public goods like transport, communication, hospitals, and schools. Second, intergovernmental grants and quality of products affect supply side of public expenditure. Third, structure of population, urbanization, and labour specialization affect only demand side of public expenditure. All these three factors are a result of a rise in public expenditure more than a rise in public income showing elasticity of more than one.

Table 2. Mathematical Formulation of Wagner's Law

S. No.	Comparison	Economists	Mathematical Formulae
1	**Absolute**	Peacock - Wiseman (1961)	$Ln\ GE = a + b\ Ln\ GDP + u_t$
2		Gupta (1967)	$Ln\ (GE/P) = a + b\ Ln\ (GDP/P) + u_t$
3		Goffman (1968)	$Ln\ GE = a + b\ Ln\ (GDP/P) + u_t$
4		Pryor (1969)	$Ln\ GCE = a + b\ Ln\ GDP + u_t$
5	**Relative**	Musgrave (1969)	$Ln\ (NGE/NGDP) = a + b\ Ln\ (GDP/P)\ u_t$
6		Mann (1980)	$Ln\ (NGE/NGDP) = a + b\ Ln\ GDP + u_t$
7	**PROPOSED EQUATION**		$\mathbf{Ln(RE) = a + b\ Ln\ (NNP) + u_t}$

Note: *NGE* = nominal government expenditure, *NGDP* = nominal GDP, *GE* = government expenditure, *GCE* = government consumption expenditure, *P* = population, *NNP* = net national product at factor cost

Source: Adapted from Verma and Arora (2010) and Demirbas (1999)

Wagner has not given any mathematical formula showing the long run positive relationship between government expenditure and GDP or NNP. However, a number of economists, in the later phase, developed mathematical formulae related to Wagner's views as shown in the Table 2.

There exists a comparative advantage based on complementarities between growth of the industrial economy and growth of public expenditure (Peacock & Scott, 2000). It shows a positive long run relationship between public expenditure and gross domestic product (GDP). Wagner theory (1883) shows that the share of public expenditure in GDP increases when economy grows because in this case, the demand for public services like banking, transport, communications, and waste disposal increases. It infers elasticity more than one between public expenditure and GDP.

The long run relationship between public expenditure and GDP has been analyzed by various economists in mathematical formulations. However, Wagner had not developed any mathematical formulation. Peacock - Wiseman (1961) formulated it in the form of $L_n GE = a + b\, L_n\, GDP$ using double log. In this case, *GE* stands for government expenditure and L_n stands for natural log. This mathematical formulation of Wagner theory entails that there is a positive relationship between government expenditure and GDP. The study of Gupta (1967) also showed that per capita government expenditure increases when per capita GDP increases. He gave a mathematical formulation of Wagner theory in the form of $L_n\,(GE/P) = a + b\, L_n\,(GDP/P)$, where *P* stands for population. Goffman (1968) developed a mathematical formulation of Wagner theory in the form of $L_n\, GE = a + b\, L_n\,(GDP/P)$. This formula also supports a positive relationship between government expenditure and per capita GDP. Pryor (1969) formulated it in the form of $L_n\, GCE = a + b\, L_n\, GDP$, where *GCE* stands for government consumption expenditure. The study of Pryor inferred a positive relationship between government consumption expenditure and GDP. In a similar form, the study of Musgrave (1969) formulated this Wagner theory in the mathematical formulation in the form of $L_n\,(NGE/NGDP) = a + b\, L_n\,(GDP/P)$, where *NGE* stands for nominal government expenditure and *NGDP* stands for nominal GDP. Prof. Musgrave also supported the positive relationship between the growth of government expenditure and growth of GDP. The study of Mann (1980) tested this positive relationship between government expenditure and GDP with the help of $L_n(NGE/NGDP) = a + b\, L_n\, NGDP$.

Literature Review

Wagner neither expressed his ideas in terms of law nor gave any mathematical formulation. However, his ideas, in later phase, were formulated both in terms of law and mathematical formulae. Peacock - Wiseman developed his ideas in mathematical formulae in 1961. Gupta developed Wagner's law in mathematical formulae in 1967. Goffman confirmed his ideas in terms of mathematical formulation in 1969. Pryor brought mathematical formula of his theory in 1969. Musgrave tested his ideas in terms of mathematical formula in 1969, while Mann generated his ideas in mathematical formulae in 1980.

There are a number of economists who have studied and tested Wagner's law by applying time series data, as shown in the Table 3. The Table 3 validates Wagner's law for a number of economies. The study of Bayrakdar, Demez, and Yapar (2015) ; Dada and Adewale (2013) ; Yaya (2016) ; Olomola (2004) ; Mann (1980) ; Oxley (1994) ; Cotsomitis, Harnhirun, and Kwan (1996) ; Burney (1999) ; Chow, Cotsomitis, and Kwan (2002) ; Dilrukshini (2009) ; and Verma and Arora (2010) strongly supported Wagner's views. Demirbas (1999), Bagdigen and Centinas (2003), and Babatunde (2008) got no empirical support for Wagner's law.

There are a number of economists who have studied and tested Wagner's ideas applying data related to the Indian economy. Bhat (1991), Lalwani (1995), Singh (1997), Sahoo (2001), and Verma and Arora (2010) found strong support for Wagner's law in the Indian economy.

All of these studies found that government expenditure increases when an economy develops. There are various reasons of rise in the public expenditure when an economy develops. The studies of Wahab (2004) and

Table 3. Literature Review Supporting and Not Supporting Wagner's Law

Economists	Country	Period	Findings
Demirbas (1999)	Turkey	1950-1990	No empirical support for Wagner's law
Bagdigen and Centinas (2003)	Turkey	1965-2000	No empirical support for Wagner's law
Olomola (2004)	Nigeria	1970-2001	Strong support for Wagner's law
Babatunde (2008)	Nigeria	1970-2005	No empirical support for Wagner's law
Mann (1980)	Mexico	1925-1976	Strong support for Wagner's law
Verma and Arora (2010)	India	1951-2008	Strong support for Wagner's law
Oxley (1994)	U.K.	1870-1913	Strong support for Wagner's law
Cotsomittis (1996)	China	1952-1992	Strong support for Wagner's law
Burney (1999)	Kuwait	1969-1994	Little support for Wagner's law
Chow (2002)	U.K.	1948-1997	Strong support for Wagner's law
Dilrukshini (2004)	Sri Lanka	1952-2002	Strong support for Wagner's law

Source: Adapted from Verma and Arora (2010) and Demirbas (1999)

Iyare and Lorde (2004) mentioned three reasons of rising government expenditure. First, the government invests and increases expenditure especially in those areas which are important for national interests but have been either ignored by the shy nature of the private sectors or have been captured by monopolistic tendencies which are necessarily to be broken. Second, administrative and protective responsibilities of the government increase for smooth functioning of the market, especially when the economy moves to industrialization, and hence, government expenditure increases. The growth of the economy generates an opportunity for the financial sector to grow (Rajasekaran, 2012) and it helps in financial inclusion (Siddik, Sun, and Kabiraj, 2015). Third, demand for superior health and education (SHE) increases when income increases, showing income elasticity of more than one, implying rise in government expenditure when an economy develops.

The present study not only tests the applicability of Wagner's view for the Indian economy, but also proposes a new mathematical formula for validating Wagner's law.

Objective, Hypothesis, and Research Methodology

(i) Objective of the Study : To find out a new model of public expenditure showing its relation with economic growth.

(ii) Hypothesis : Public expenditure has a positive relationship with economic development but the proposed model does not show this relationship applicable both in the short as well as in the long run.

(iii) Research Methodology : The present study is fully based on secondary data culled from International Financial Statistics (IFS), Government Financial Statistics (GFS) published by the International Monetary Fund (IMF) and Reserve Bank of India's *Handbook of Statistics on Indian Economy*. Data on government expenditure were also taken from *Economic and Functional Classification of the Central Government* and *Indian Public Finance Statistics* provided by Ministry of Finance, Government of India. GFS provides data on government expenditure *(GE),* while IFS provides data on government consumption expenditure *(GCE),* gross domestic product *(GDP),* and population *(P)*. Secondary data were taken for the period of 1951 - 2015 for the present study.

All variables have been neutralized from price variation by deflating at 2004-05 prices. A natural log (L_n) of all variables has been utilized for estimating the relative elasticity. L_n helps in achieving stationarity (i.e. means, variance, and covariance are constant) in lower order of integration. Engle and Granger's (1987) cointegration approach has been used to test the Wagner hypothesis stating the relationship between economic growth and government expenditure growth. Stationarity of the time series data has been tested with the help of unit root test (URT). The presence of URT disturbs the accuracy of the parameter showing presence of non - stationarity in data and hence it makes regression results spurious (i.e. R^2 > Durbin - Watson (D -W) statistics which implies type-1 error carrying the meaning that variables are highly correlated, but actually they are not correlated). Augmented Dickey Fuller (ADF) statistics were applied to test the stationary at the level of data. When data are not stationary at their level, then differences of data are estimated until they become stationary. A study of Asteriou and Hall (2007) showed that a model neither gives unique long run solution, if one differences the variables, nor saves from losing one degree of freedom. Therefore, if cointegration exists and unit root is present in H_o along with ADF > critical value of Engle - Granger, then the error correction mechanism (ECM) is applied. The presence of URT in H_o (i.e. null hypothesis) shows that residuals are stationary at their level.

The existence of cointegration can be certified by the satisfaction of the following conditions :

(i) Unit root is present in H_o in residuals,
(ii) ADF is greater than the Engle - Granger critical value,
(iii) Residuals are stationary at the level.

If the above three conditions are fulfilled, it is said that the variables are cointegrated. This cointegration carries a meaning of long run equilibrium (LRE) relationship between variables certifying existence of the long run model. The coefficient of this long run model is known as long run coefficient. This coefficient becomes significant when *p* - value (*F*-statistics) is less than 0.5. This significant coefficient shows that the independent variable is a significant variable to explain the dependent variable.

The theory behind the least square method of analyzing time - series data may be stated in the following ways - if the variables in the model are non-stationary, then the estimated regression model is spurious. This theory, for testing, needs an assumption which can be stated in the following way - if the variables are non-stationary at their levels, it carries a meaning that these variables have unit root at the level, but when one converts these variables into first difference, they become stationary. It requires the following methods to be adopted.

(i) Method 1 - Adopted Model is Spurious or Not : This Method 1 requires the following processes to be followed. First, the regression line is estimated, say it is $Y = a + b X$. Second, if the *p*-value of this line is less than 0.5, it certifies that coefficient *"b"* is significant and independent variable *"X"* is a significant variable to explain the dependent variable *"Y"*. Third, when R^2 of this model is greater than Durbin - Watson statistics, it shows that the regression model is spurious. Therefore, the model cannot be accepted because it is non-desirable because it is spurious.

In Method 1, if the model becomes spurious (R^2 > D- W), one should further investigate the stationarity of residuals because if the residuals of the model become stationary, the model is no longer spurious.

(ii) Method 2 - Residual is Stationary or Not : This Method 2 requires the following processes to be followed. First, two hypotheses are taken - H_o (null hypothesis) and H_A (alternate hypothesis). Existence of unit root in H_o shows that residual is non-stationary. Second, one should compare between ADF and Engle - Granger critical value. When ADF is absolutely more than absolute value of this critical value, the H_o is rejected and H_A is accepted. What is H_A? H_A shows that there is no unit root in residual. Therefore, residual is stationary and hence, the model is not spurious.

From Method 1 and Method 2, one can conclude that if the variables are non-stationary at level, still one can run the regression model provided residual of model is stationary. This is the situation of existence of cointegration. This cointegration certifies the existence of long run equilibrium relationship between the variables. In this case, in model $Y = a + bX$, the long run coefficient is *"b"* and is significant when its p - value is less than 0.5.

When one gets satisfied that the variables are cointegrated, one should only then run the error correction mechanism (ECM). ECM gives three facts. First, the speed of adjustment of error, that corrects the disequilibrium. Second, the model is not related with short run and hence, the independent variable is not a significant variable to explain the dependent variable. Third, it validates the existence of a long run relationship between variables. ECM requires the following processes to be followed. One should get regression line of first difference of dependent variable, independent variable, and one period lag residual values. Therefore, the equation takes the form of $D(Y) = a + b\,D(X) - cR(-1)$. Here $D(Y)$ shows that Y becomes stationary after first difference . $D(X)$ shows that X becomes stationary after first difference. $R(-1)$ is residual of one period lag. Here, *"b"* is the short run coefficient and not significant if its p-value > 0.5, showing that X is not a significant variable to explain the dependent variable Y. The error correction term *"c"* shows the speed at which it corrects the disequilibrium annually if data are taken on an annual basis. The sign of error correction term is negative with significant p- value < 0.5, which validates the long run relationship between variables. If the R^2 < D - W, it shows that the model is not spurious and hence, ECM is subject to be accepted.

Analysis and Results

On the basis of the above secondary data, models, both previous and proposed one, have been tested on the following three econometric tools :

(1) Spuriousness test,
(2) Stationary test of residuals,
(3) Error correction speed test.

(1) Spuriousness Test : All model equations studied earlier and proposed one have been tested on the basis of R^2 and Durbin-Watson statistics to know whether equations are spurious or not as shown in the Table 4. R^2 is more than D-W statistics in the equations proposed by Peacock - Wiseman (1961), Gupta (1967), and Goffman (1968). This reveals that their proposed equations suffered from spuriousness, which is non - desirable and not acceptable because their p - value is less than 0.5, which signifies the spuriousness of equations. The proposed equations of Pryor (1969), Musgrave (1969), and Mann (1980) are not spurious because R^2 is less than the D - W statistics, p - values of all coefficients of equations are less than 0.5, and regression coefficients of all equations are positive. Therefore, all equations confirm the existence of a positive relationship between government expenditure and economic development. In most of the cases, except for Musgrave (1969) and Mann (1980), the regression coefficient is more than one, implying elasticity, which implies that when economy grows, the public expenditure rises. In this sense, the elasticity is the highest in the case of the proposed equation by us. This elasticity is very much comparable with elasticity of the model proposed by Pryor (1969).

(2) Stationary Test of Residuals : The stationary test of residuals, as stated earlier, requires finding out whether unit root exists in the H_o or not. If unit root exists, it infers that residual is in non stationary state. The Table 5 certifies the existence of unit root in H_o in all models including the proposed one. Therefore, residuals are in non stationary states in all models.

Table 4. Spuriousness Test

Economists	Efficiency Test Based on Econometric Analysis						
	A	*B*	R^2	S^2	Significant (*p* - value < 0.5)	D - W	Spurious (R^2 >D- W)
Peacock-Wiseman (1961)	-3.69	1.14	0.99	0.82	0.00	0.85	Spurious
Gupta (1967)	-3.32	1.16	0.99	0.85	0.00	0.85	Spurious
Goffman (1968)	-0.80	1.38	0.99	1.06	0.00	0.84	Spurious
Pryor (1969)	**-2.78**	**1.04**	**0.99**	**0.11**	**0.00**	**1.23**	**Not spurious**
Musgrave (1969)	-3.32	0.17	0.64	0.84	0.00	0.85	Not spurious
Mann (1980)	-3.69	0.14	0.65	0.82	0.00	0.85	Not spurious
PROPOSED BY							
SHAKTI - SUBHASH (2017)	**-27.0**	**3.94**	**0.76**	**40.86**	**0.00**	**1.55**	**NOT SPURIOUS**

Table 5. Stationary Test of Residuals

Economists	Efficiency Test Based on Econometric Analysis					Stationary
	Unit Root	ADF	R^2	D-W	Significant (*p* -value < 0.5)	(ADF > 3.04)
Peacock - Wiseman (1961)	Exists in H0	- 3.10	0.36	0.78	0.04	**Stationary**
Gupta (1967)	Exists in H0	-3.16	0.37	0.76	0.03	**Stationary**
Goffman (1968)	Exists in H0	- 3.36	0.39	0.70	0.02	**Stationary**
Pryor (1969)	**Exists in H0**	**- 2.29**	**0.27**	**1.69**	**0.18**	**Not stationary**
Musgrave (1969)	Exists in H0	- 3.16	0.37	0.77	0.38	**Stationary**
Mann (1980)	Exists in H0	- 3.10	0.36	0.78	0.04	**Stationary**
PROPOSED BY						
Shakti -Subhash (2017)	**Exists in H0**	**- 3.72**	**0.44**	**1.52**	**0.01**	**Stationary**

Engle-Granger critical value at 10.00 % is 3.04

Now one should try to find out whether H_o is subject to be rejected or to be accepted. The acceptance or rejection requires comparative analysis between ADF and Engle-Granger critical value. When ADF is absolutely more than the absolute value of this critical value, the H_o is rejected and H_A is accepted. The absolute value of ADF in the all models, including the proposed one, is more than absolute value of this critical value except in case of the Pryor model. Therefore H_o will be rejected and H_A will be accepted in all models except for the Pryor model. H_o is nothing but existence of unit root in residual and H_A is nothing but non - existence of unit root in residuals. Therefore, unit root does not exist in H_A of all models, including the proposed one, and hence they are in stationary states. From above, one can conclude that the time - series data are non-stationary at level, but their residuals are in the stationary states. This is the situation of existence of cointegration in all models. Therefore, the variables are cointegrated in all models. This cointegration certifies the existence of long run equilibrium relationship between variables. When one gets satisfied that variables are cointegrated, one should only then run the error correction mechanism (ECM).

(3) Error Correction Speed Test : To know the applicability of the model in the short run or in the long run along with speed of correction in the error, one should apply ECM as it has been applied in the Table 6. ECM gives three results as mentioned below :

Table 6. Error Correction Mechanism

Economists	C		D(IV) (Short term)		U(-1) One Period Lag Residual (Long Term)		R^2	D - W	Spurious
	Coefficient	*p* -value	Coefficient	*p* - value	Coefficient	*p* - value			
Peacock-Wiseman (1961)	0.004	0.93	1.21	0.00	-0.66	0.00	0.91	0.83	Spurious
Gupta (1967)	0.01	0.84	1.24	0.00	- 0.65	0.00	0.88	0.81	Spurious
Goffman (1968)	0.0005	0.93	1.50	0.00	- 0.70	0.0	0.90	0.81	Spurious
Pryor (1969)	-0.01	0.23	1.12	0.00	**- 0.95**	0.00	0.99	1.44	Not Spurious
Musgrave (1969)	-0.03	0.32	0.32	0.00	**- 0.69**	0.00	0.63	0.82	Not Spurious
Mann (1980)	0.004	0.93	0.21	0.03	**- 0.66**	0.00	0.38	0.83	Not Spurious
Proposed by **Shakti -Subhash (2017)**	**0.13**	**0.73**	**2.23**	**0.11**	**- 0.72**	**0.00**	**0.37**	**2.20**	**Not Spurious**

D (DV) = First difference dependent variable, *D(IV)* = First difference independent variable

U(-1) = One period lag residual   *C* = Intercept

(i) Applicability of the Model in the Short Run : The regression line between first difference of dependent variable and first difference of independent variable along with one period lag residual variable shows the applicability of the model in the short run. As can be inferred from the Table 6, short run coefficients of the equations in all models are supported with *p* - value less than 0.5 showing significant effect of dependent variable in the short run on the independent variable. Therefore, all models, including the proposed one, are applicable in the short run in the Indian economy. Hence, it can be inferred that if income of India fluctuates even in the short run, the expenditure is bound to fluctuate.

(ii) Applicability of the Model in the Long Run : The sign of the coefficient of one period lag residual variable is negative which is being supported with less than 0.5 value of *p*. It shows applicability of the model in the long run as the independent variables are able to affect dependent variable in the long run in all models. Therefore, all models are applicable in India in the long run. So, any change in the income in the long run generates changes in the public expenditure in the long run.

(iii) Speed of Correcting Errors : The coefficient of one period lag residual variable shows the rate of correction in errors. Since the data have been taken on an annual basis, the errors are being corrected annually in the terms of per cent. The rate of correction in the error is the highest in the case of the Pryor model, but it is in the non-stationary state as shown in the Table 5. The next highest rate of error correction occurs with the model proposed by us.

Discussion

The present study deals with public expenditure of India. This public expenditure has shown a trend of rise over the period along with upward movement of GDP. When an economy develops, the public expenditure also rises, and hence, there exists a positive relationship, as shown by all models, between a change in the public expenditure and a change in the GDP.

Three tests were conducted namely spuriousness test, stationary test of residuals, and error correction speed test. The model proposed by us (Shakti - Subhash Model, 2017) has been compared, as shown in the Table 7, on the basis of the above three tests. The proposed model (Shakti - Subhash Model, 2017) is not spurious while the

Table 7. Comparison of Previous Models with the Shakti - Subhash Model (2017)

			Findings				
Economists	**Equation Model (Spurious)**	**Stationary of Residuals**	**Applicable in (Error Correction Mechanism)**				**Comparison with Authors Findings**
			Short Run	**Long Run**	**Spurious**	**Rate of Error Correction**	
Peacock-Wiseman (1961)	Spurious	Stationary	Yes	Yes	Spurious	66.00	Inferior (Speed < 72.00)
Gupta (1967)	Spurious	Stationary	Yes	Yes	Spurious	65.00	Inferior (Speed < 72.00)
Goffman (1968)	Spurious	Stationary	Yes	Yes	Spurious	70.00	Inferior (Speed < 72.00)
Pryor (1969)	Not Spurious	Not Stationary	Yes	Yes	Not Spurious	95.00	Inferior (Speed > 72.00) but residuals are not stationary
Musgrave (1969)	Not Spurious	Stationary	Yes	Yes	Not Spurious	69.00	Inferior (Speed < 72.00)
Mann (1980)	Not Spurious	Stationary	Yes	Yes	Not Spurious	66.00	Inferior (Speed < 72.00)
Proposed by Shakti - Subhash (2017)	**Not Spurious**	**Stationary**	**Yes**	**Yes**	**Not Spurious**	**72**	**Better Findings**

models of Peacock-Wiseman (1961), Gupta (1967), and Goffman (1968) suffer from spuriousness. Only the Pryor Model is not stationary, while the proposed model (Shakti - Subhash Model, 2017) along with the rest of the models is stationary. Hence, all models along with the proposed one (Shakti - Subhash Model, 2017) are applicable in the long run as well as in the short run. Per annum rate of correction of error is highest in the case of Pryor model, but this model is not stationary. The second highest per annum rate of correction of error exists with the proposed model, which is in the stationary state. Therefore, the present model is superior to the other models. All models are inferior to the proposed model (Shakti - Subhash Model, 2017) because their rate of correction of error is less than the rate of the proposed model as shown in the Table 7.

Public expenditure shows a positive relationship with economic development but the proposed model shows this relationship applicable both in the short as well as in the long run. Therefore, the proposed hypothesis is rejected. Hence, the proposed model is applicable both in short as well as in the long run and is able to give best rate of error correction. When income of an individual or of an economy increases, expenditure also increases, showing a positive relationship, which has also been confirmed with the use of mathematical formulae.

Research Implications

The present study implicates an idea knowing the relationship between income and expenditure. The proposed model helps in correcting error in the lowest possible time to come back on the equilibrium path. All mathematical formulae, including the proposed one, find that Wagner's law is applicable both in short as well as in the long run in the Indian economy. But the proposed model is able to give highest speed of correcting error in comparison of other models given earlier. Models given by Peacock-Wiseman (1961), Gupta (1967), Goffman (1968), Musgrave (1969), and Mann (1980) are able to give rate of correcting error less than the model proposed by us (Shakti - Subhash Model, 2017). The model given by Pryor (1969) is able to give rate of correcting error more than the model proposed by us (Shakti - Subhash Model, 2017), but the residuals are not in stationary state in Pryor model, while these residuals are in the stationary state in our model. Therefore, the present study finds that the proposed model is better in correcting errors in the Indian economy in comparison to other models.

Conclusion

All models along with the proposed one are applicable in India both in the short run as well as in the long run. Public expenditure shows a positive relationship with Indian economic development. Revenue expenditure is much higher than is capital expenditure in India. This rise in revenue expenditure is problematic both in the short run as well as in the long run for India. Therefore, revenue expenditure should be minimized and capital expenditure should be increased for the economic development of India. The speed of correcting error is highest in case of the proposed model, showing that revenue expenditure should be associated with national income. This revenue expenditure of India is rising and shows a positive relationship with rise in national income of India.

Limitations of the Study and Scope for Further Research

The present study bears a limitation of taking data only for the Indian economy. In future studies, the proposed model can be tested for other economies. Other variables can also be taken to ascertain the relationship between income and expenditure.

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