Advances in Applied Economics and Finance
Vol. 1, No. 2, 2012

www.worldsciencepublisher.org

On the Relationship between Government's Developmental Expenditure and Economic Growth in India: A Cointegration Analysis

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Abstract-The paper tries to assess empirically the nexus between government's developmental expenditure and economic growth in India using annual data over the period 1961-62 to 2009-10. The paper is based on the following hypotheses for testing the causality and co-integration between GDP growth and government's developmental expenditure in India as to whether there is bi-directional causality between GDP growth and govt. spending or whether there is unidirectional causality between the two variables or whether there is no causality between GDP growth and govt. spending in India or whether there exists a long run relationship between GDP growth and govt. spending in India. Time-series econometric techniques like Granger causality and cointegration, error correction model are applied to test the hypothesis. The cointegration test confirmed that economic growth and government's developmental expenditure are co integrated that indicates an existence of long run equilibrium relationship between the two as confirmed by the Johansen cointegration test results. The Granger causality test finally confirmed the absence of any kind of short run causality between economic growth and developmental expenditure of government which neither supports Keynesian approach nor Wagner's law. The error correction estimates gave evidence that developmental expenditure of government (DEV) and GDPgrowth are mutually causal.

Keywords: Government's developmental expenditure; economic growth; India; causality; cointegration; error correction model.

1. Introduction:

The relationship between government's developmental expenditure and economic growth via GDP growth has attracted consideration academic attention among economists and policy makers all over the world. This nexus is generally based on two approaches-Keynesian approach and Wagner's law. Keynesian effect and Wagner's Law depicts two different position regarding relationship between government's overall expenditure and economic growth. According to Keynesian approach (1936), causality runs from government spending to economic growth whereas Wagner's law postulates that causality runs in the opposite direction –from economic growth to government spending. Government's intervention can affect economic growth in positive direction because government supplies pure public goods that constitute a sizeable component of aggregate demand. Regulations and control imposed by government can assist the protection of property rights and enhance allocative efficiency in the presence of externalities. Therefore, according to Keynesians thought, public expenditure is the real tool to boost the economic activities in the economy and also a tool to bring stability in the short run fluctuations in aggregate expenditure (Singh and Sahni, 1984).

Wagner's law(1883) suggests a different direction of causality between government spending and economic growth which states that in the process of economic development, government spending tend to expand relative to national income because economic development results in the expansion of cultural and welfare expenditure and government intervention may be needed to manage and finance natural monopolies. "Wagner law" is based on the hypotheses that government expenditure increases more than proportionally with economic activity. The underlying idea is that goods and services generally provided by the government sector, including redistribution via transfers and the activities of public enterprises, have an income elastic greater then one, i.e., are superior goods. In both approaches, the focus is only to the unidirectional causal link between the public expenditure and national income.

Despite there have been several attempts to investigate the relationship between government's spending and economic growth in developed countries, no comprehensive studies have been conducted so far in a developing country like India to investigate the causal relationship between government's developmental expenditure and economic growth.

The paper is, therefore, a contribution to fill the gap existed in the literature in developing countries like India by modeling short run and long run dynamic interactions between government's developmental expenditure and economic growth.

The structure of the article is as follows: section 2 briefly reviews the existing literature, section 3 discusses the methodological issues, and section 4 presents empirical results based on econometric methodology and finally section 5 presents summary and conclusions.

2. Literature review:

Several studies have been conducted on the empirical nexus between government's spending and economic growth all over the world during the last couple of decades but results arrived at are too diverse. Ahsan et al. (1989), Ram (1986), Holmes and Hutton (1990) and Singh and Sahni (1984) concluded that public expenditure expansion has significant effect on national income growth. On the contrary, Barth, et al. (1990) and Landau (1983, 1986) found that public expenditure expansion has negative effect on national income growth for both developed and less developed countries. In a most recent study conducted by Sakthivel and Yadav (2007) for India found bidirectional causality between national income and public expenditure and economic services. They also analyzed causality between income, defense services and interest payments. Defense services found independent and interest payments have unidirectional relationship with income. Some studies also found no pattern of causality between public expenditure and national income growth, for instance, Ram (1986) in his study of 63 countries, Ahsan et al. (1992) for US data and Conte and Darrat (1988) for OECD countries, found no consistent causality between these two variables. Afxentiou and Serletis (1991) found the contradicting results to what has been subjected by the Wagnerian and Keynesian in Canada over the period of 1947 to 1986. Ahsan et al. (1992) found no evidence of causality at the bivariate level in case of Canada, Germany and the US. However, this result was no longer valid in trivariate context (third variable was the stock of money). Cheng and Lai (1997) found bidirectional causality between government expenditure and economic growth in South Korea and their results support both the conventional frameworks of Keynes and Wagner. Similarly Park (1996) studied both Wagner's and Keynes hypothesis for Korea using different functional forms nonetheless he strongly supported the Wagner's law in four out of six functional forms. Abizadeh and Yousefi (1998) indicated that private sector's income granger cause expenditure growth.

Kormendi and Meguire (1985) studied based on post-war data from 47 countries and found no significant relationship between average growth rates of real GDP and average growth rate or levels of the share of government consumption spending in GDP.

Grier and Tullock (1987) studied 115 countries on a cross-sectional, time series analysis, using data averaged over 5-year intervals. They found evidence of a negative relationship between the growth rate of real GDP and the growth rate of the government share of GDP.

Barro (1990) investigated an endogenous growth model that suggests a possible relationship between the share of government spending in GDP and the growth rate of per capita real GDP. The main feature of Barro's model is the presence of constant returns to capital that broadly includes private capital and public services. The role of puplic services are considered as an input to private production. This productive role creates a potentially positive linkage between government spending and economic growth.

Barro (1991), using a sample of 98 countries for the period 1970-1985, found a negative relationship between the output rate and the share of government consumption expenditures. However, when the share of public investment was considered, Barro (1991) found a positive but statistically insignificant relationship between public investment and the output growth rate.

Ramayandi (2003) investigated the impact of government size on economic growth using a sample of time series data on Indonesia (1969-1999). He found consistent evidence that the share of government consumption spending decreases economic growth. Surprisingly, the share of government investment also shows negative effect on growth.

Sáez and García (2006) studied the relationship between government expenditure and economic growth in the EU-15 countries. The results obtained based on regressions and panel techniques suggest that government spending is positively related with economic growth in the EU countries.

Recently, Taban (2010) investigate this issue empirically by using the data of the share of government consumption spending on goods and services in GDP. From his empirical exercise, he found no consistent evidence that there is a relationship between government consumption spending and economic growth in Turkey. From this compelling argument, the objective of this study is to empirically re-investigate the linkages between government spending and economic growth in Turkey with the bounds testing for cointegration approach developed by Pesaran et al. (2001) and the modified WALD (MWALD) causality test developed by Toda and Yamamoto (1995).

3. Methodology:

3.1. Data and Variables:

The objective of this paper is to investigate the dynamics of the relationship between developmental expenditure of Govt. and economic growth in India using the annual data for the period 1961-62 to 2009-10 which includes the 49 annual observations. The two main variables of this study are economic growth and developmental expenditure of Govt. The real Gross Domestic Product (GDP)growth is used as the proxy for economic growth in India and we represent the economic growth rate by using the constant value of Gross Domestic Product (GDP) measured in Indian rupee. All necessary data for the sample period are obtained from the Handbook of Statistics on Indian Economy, 2010-11 published by Reserve Bank of India. Developmental expenditure of government which consists of economic service and social service is also taken from the Handbook of Statistics on Indian Economy, 2010-11 published by Reserve Bank of India .All the variables are taken in their natural logarithms to reduce the problems of heteroscedasticity to some extent.

Using the time period 1961-62 to 2009-10 for India, this study aims to examine the long-term and causal dynamic relationships between the level of government's developmental expenditure and economic growth. The estimation methodology employed in this study is the cointegration and error correction modeling technique.

The entire estimation procedure consists of three steps: first, unit root test; second, cointegration test; third, the error correction model estimation.

3.2. Econometric specification:

3.2.1.Hypothesis:

The paper is based on the following hypotheses for testing the causality and co-integration between GDPgrowth and developmental expenditure of government (DEV) in India (i) whether there is bi-directional causality between GDP growth and DEV, (ii) whether there is unidirectional causality between the two variables, (iii) whether there is no causality between GDPgrowth and DEV in India (iv) whether there exists a long run relationship between GDPgrowth and DEV in India.

3.2.2.Model Specification:

The choice of the existing model is based on the fact that it allows for generation and estimation of all the parameters without resulting into unnecessary data mining.

The growth model for the study takes the form: GDP=f (DEV) ----------------------------------(1)

Where GDP and DEV are the gross domestic product and developmental expenditure of government respectively.

Equation (1) is treated as a Cobb-Douglas function with investment in Developmental expenditure of government, DEV, as the only explanatory variable.

The link between Economic growth (measured in terms of GDP growth) and DEV in India can be described using the following model in linear form:

$LnGDP_t = \alpha + \beta LnDEV_t + \varepsilon_t$ -------------- (1.1)
α and $\beta>0$

The variables remain as previously defined with the exception of being in their natural log form. εt is the error term assumed to be normally, identically and independently distributed.

where, GDP_t and DEV_t show the Gross Domestic Product annual growth rate and Developmental expenditure of government at a particular time respectively while ε_t represents the “noise” or error term; α and β represent the slope and coefficient of regression. The coefficient of regression, β indicates how a unit change in the independent variable (Developmental expenditure of government) affects the dependent variable (gross domestic product). The error, ε_t , is incorporated in the equation to cater for other factors that may influence GDP. The validity or strength of the Ordinary Least Squares method depends on the accuracy of assumptions. In this study, the Gauss-Markov assumptions are used and they include; that the dependent and independent variables (GDP and DEV) are linearly co-related, the estimators (α, β) are unbiased with an expected value of zero i.e., E (ε_t) = 0, which implies that on average the errors cancel out each other. The procedure involves specifying the dependent and independent variables; in this case, GDP is the dependent variable while DEV the independent variable.

But it depends on the assumptions that the results of the methods can be adversely affected by outliers. In addition, whereas the Ordinary Least squares regression analysis can establish the dependence of either GDP on DEV or vice versa; this does not necessarily imply direction of causation. Stuart Kendal noted that “a statistical relationship, however, strong and however suggestive, can never establish causal connection.” Thus, in this study, another method, the Granger causality test, is used to further test for the direction of causality.

Step –I: Ordinary least square method:

Here we will assume the hypothesis that there is no relationship between government’s developmental expenditure (DEV) and Economic Growth in terms of GDP. To confirm about our hypothesis, primarily, we have studied the effect of foreign trade on economic growth and vice versa by two simple regression equations:

$DEV_i = a + b*GDP_i$ ………………………………..(2)
$GDP_i = a_1 + b_1*DEV_i$…………………………………(3)
GDP = Gross domestic product.
DEV = Developmental expenditure of government in India.
t= time subscript.

This study aimed to examine the long-term relationship between developmental expenditure of government and GDP growth in India between 1961-62 and 2009-10. Using co-integration and Vector Error Correction Model (VECM) procedures, we investigated the relationship between these two variables. The likely short-term properties of the relationship among economic growth and foreign were obtained from the VECM application. Next, unit root, VAR, cointegration and Vector Error Correction Model (VECM) procedures were utilized in turn. The first step for an appropriate analysis is to determine if the data series are stationary or not. Time series data generally tend to be non-stationary, and thus they suffer from unit roots. Due to the non-stationarity, regressions with time series data are very likely to result in spurious results. The problems stemming from spurious regression have been described by Granger and Newbold (1974). In order to ensure the condition of stationarity, a series ought to be integrated to the order of 0 [I(0)]. In this study, tests of stationarity, commonly known as unit root tests, were adopted from Dickey and Fuller (1979, 1981).As the data were analyzed, we discovered that error terms had been correlated in the time series data used in this study.

*Step –II**:** The Stationarity Test (Unit Root Test):*

It is suggested that when dealing with time series data, a number of econometric issues can influence the estimation of parameters using OLS. Regressing a time series variable on another time series variable using the

Ordinary Least Squares (OLS) estimation can obtain a very high R^2, although there is no meaningful relationship between the variables. This situation reflects the problem of spurious regression between totally unrelated variables generated by a non-stationary process. Therefore, prior to testing Cointegration and implementing the Granger Causality test, econometric methodology needs to examine the stationary ;for each individual time series, most macro economic data are non stationary, i.e. they tend to exhibit a deterministic and/or stochastic trend. Therefore, it is recommended that a stationarity (unit root) test be carried out to test for the order of integration. A series is said to be stationary if the mean and variance are time-invariant. A non-stationary time series will have a time dependent mean or make sure that the variables are stationary, because if they are not, the standard assumptions for asymptotic analysis in the Granger test will not be valid. Therefore, a stochastic process that is said to be stationary simply implies that the mean $[(E(Y_t)]$ and the variance $[Var(Y_t)]$ of Y remain constant over time for all t, and the covariance $[covar(Y_t, Ys)]$ and hence the correlation between any two values of Y taken from different time periods depends on the difference apart in time between the two values for all t≠s. Since standard regression analysis requires that data series be stationary, it is obviously important that we first test for this requirement to determine whether the series used in the regression process is a difference stationary or a trend stationary. The Augmented Dickey-Fuller (ADF) test is used. To test the stationary of variables, we use the Augmented Dickey Fuller (ADF) test which is mostly used to test for unit root. Following equation checks the stationarity of time series data used in the study:

$$\Delta y_t = \beta_1 + \beta_1 t + \alpha y_{t-1} + \gamma \Sigma \Delta y_{t-1} + \varepsilon_t$$

Where ε_t is white nose error term in the model of unit root test, with a null hypothesis that variable has unit root. The ADF regression test for the existence of unit root of y_t that represents all variables (in the natural logarithmic form) at time t. The test for a unit root is conducted on the coefficient of yt-1 in the regression. If the coefficient is significantly different from zero (less than zero) then the hypothesis that y contains a unit root is rejected. The null and alternative hypothesis for the existence of unit root in variable y_t is H0; $\alpha = 0$ versus H1: $\alpha < 0$. Rejection of the null hypothesis denotes stationarity in the series.

If the ADF test-statistic (t-statistic) is less (in the absolute value) than the Mackinnon critical t-values, the null hypothesis of a unit root can not be rejected for the time series and hence, one can conclude that the series is non-stationary at their levels. The unit root test tests for the existence of a unit root in two cases: with intercept only and with intercept and trend to take into the account the impact of the trend on the series.

Once the number of unit roots in the series was decided, the next step before applying Johansen's (1988) co-integration test was to determine an appropriate number of lags to be used in estimation. Second, Eagle-Granger residual based test tests the existence of co integration among the variables-DEV and GDP at constant prices for the economy. Third, if a co integration relationship does not exist, VAR analysis in the first difference is applied, however, if the variables are co integrated, the analysis continues in a cointegration framework.

Step-III: Testing for Cointegration Test(Johansen Approach):

Cointegration, an econometric property of time series variable, is a precondition for the existence of a long run or equilibrium economic relationship between two or more variables having unit roots (i.e. Integrated of order one). The Johansen approach can determine the number of co-integrated vectors for any given number of non-stationary variables of the same order. Two or more random variables are said to be cointegrated if each of the series are themselves non – stationary. This test may be regarded as a long run equilibrium relationship among the variables. The purpose of the Cointegration tests is to determine whether a group of non – stationary series is cointegrated or not.

Having concluded from the ADF results that each time series is non-stationary, i.e it is integrated of order one I(1), we proceed to the second step, which requires that the two time series be co-integrated. In other words, we have to examine whether or not there exists a long run relationship between variables (stable and non-spurious co-integrated relationship). In our case, the mission is to determine whether or not Developmental expenditure of government (DEV) and economic growth (GDPgrowth) variables have a long-run relationship in a bivariate framework. Engle and Granger (1987) introduced the concept of cointegration, where economic variables might reach a long-run equilibrium that reflects a stable relationship among them. For the variables to be co-integrated, they must be integrated of order one (non-stationary) and the linear combination of them is stationary I(0).

The crucial approach which is used in this study to test r cointegration is called the Johansen cointegration approach. The Johanson approach can determine the number of cointegrated vectors for any given number of non-stationary variables of the same order.

Step-IV: The Granger Causality test :

Causality is a kind of statistical feedback concept which is widely used in the building of forecasting models. Historically, Granger (1969) and Sim (1972) were the ones who formalized the application of causality in economics. Granger causality test is a technique for determining whether one time series is significant in forecasting another (Granger. 1969). The standard Granger causality test (Granger, 1988) seeks to determine whether past values of a variable helps to predict changes in another variable. The definition states that in the conditional distribution, lagged values of Y_t add no information to explanation of movements of X_t beyond that provided by lagged values of X_t itself (Green, 2003). We should take note of the fact that the Granger causality technique measures the information given by one variable in explaining the latest value of another variable. In addition, it also says that variable Y is Granger caused by variable X if variable X assists in predicting the value of variable Y. If this is the case, it means that the lagged values of variable X are statistically significant in explaining variable Y. The null hypothesis (H_0) that we test in this case is that the X variable does not Granger cause variable Y and variable Y does not Granger cause variable X.In summary, one variable (X_t) is said to granger cause another variable (Y_t) if the lagged values of X_t can predict Y_t and vice-versa.

DEV and GDP are, in fact, interlinked and co-related through various channel. There is no theoretical or empirical evidence that could conclusively indicate sequencing from either direction. For this reason, the Granger Causality test was carried out on DEV and GDP. The spirit of Engle and Granger (1987) lies in the idea that if the two variables are integrated as order one, I(1), and both residuals are I(0), this indicates that the two variables are cointegrated. The Granger theorem states that if this is the case, the two variables could be generated by a dynamic relationship from GDP to DEV and, vise versa.

Therefore, a time series X is said to Granger-cause Y if it can be shown through a series of F-tests on lagged values of X (and with lagged values of Y also known) that those X values predict statistically significant information about future values of Y. In the context of this analysis, the Granger method involves the estimation of the following equations:

If causality (or causation) runs from DEV to GDP, we have:

$$dLnGDP_{it} = \eta_i + \Sigma\alpha_{11} dLnGDP_{i,\ t-1} + \Sigma\beta_{11} dLnDEV_{i,\ t-1} + \varepsilon_{1t} \ldots\ldots(4)$$

If causality (or causation) runs from GDP to DEV, it takes the form:

$$dLnDEV_{it} = \eta_i + \Sigma\alpha_{12} dLnDEV_{i,t-1} + \Sigma\beta_{12} dLnGDP_{i,t-1} + \lambda ECM_{it} + \varepsilon_{2t} \ldots\ldots(5)$$

where GDP_t and DEV_t represent gross domestic product and developmental expenditure of government respectively, ε_{it} is uncorrelated stationary random process, and subscript *t* denotes the time period. In equation 4,failing to reject: H_0: $\alpha_{11} = \beta_{11} = 0$ implies that Developmental expenditure of government does not Granger cause economic growth. On the other hand, in equation5, failing to reject H_0: $\alpha_{12} = \beta_{12} = 0$ implies that economic growth via GDP growth does not Granger cause Developmental expenditure of government.

The decision rule:

From equation (4), $dLnDEV_{i\ t-1}$ Granger causes $dLnGDP_{i\ t}$ if the coefficient of the lagged values of DEV as a group (β_{11}) is significantly different from zero based on F-test (i.e., statistically significant). Similarly, from equation (5), $dLnGDP_{i,t-1}$ Granger causes $dLnDEV_{it}$ if $\beta_{12}$is statistically significant.

Step V:Error Correcting Model (ECM) and Short Term Causality Test :

Error correction mechanism was first used by Sargan (1984), later adopted, modified and popularized by Engle and Granger (1987). By definition, error correction mechanism is a means of reconciling the short-run behaviour (or value) of an economic variable with its long-run behaviour (or value). An important theorem in this regard is the Granger Representation Theorem which demonstrates that any set of cointegrated time series has an error correction representation, which reflects the short-run adjustment mechanism.

Co- integration relationships just reflect the long term balanced relations between relevant variables. In order to cover the shortage, correcting mechanism of short term deviation from long term balance could be cited. At the same time, as the limited number of years, the above test result may cause disputes (Christpoulos and Tsionas, 2004). Therefore, under the circumstance of long term causalities, short term causalities should be further tested as well. Empirical works based on time series data assume that the underlying time series is stationary. However, many studies have shown that majority of time series variables are nonstationary or integrated of order 1 (Engle and Granger, 1987). The time series properties of the data at hand are therefore studied in the outset. Formal tests will be carried out to find the time series properties of the variables. If the variables are *I* (1), Engle and Granger (1987) assert that causality must exist in, at least, one direction. The Granger causality test is then augmented with an error correction term (ECT) and the error correcting models could be built as below:

$$dLnGDP_{it} = \eta_i + \Sigma\alpha_{11} dLnGDP_{i,\ t-1} + \Sigma\beta_{11} dLnDEV_{i,\ t-1} + \lambda ECM_{it} + \varepsilon_{it} \ldots\ldots(6)$$

$$dLnDEV_{it} = \eta_i + \Sigma\alpha_{12} dLnDEV_{it-1} + \Sigma\beta_{12} dLnGDP_{i,t-1} + \lambda ECM_{it} + \varepsilon_{it} \ldots\ldots(7)$$

Where t represents year, d rerepresents first order difference calculation, ECM_{it} represents the errors of long term balance which is obtained from the long run co-integrating relationship between economic growth and educational expenditure. If $\lambda = 0$ is rejected, error correcting mechanism happens, and the tested long term causality is reliable, otherwise, it could be unreliable. If $\beta 1=0$ is rejected, and then the short term causality is proved, otherwise the short term causality doesn't exist.

4. Analysis of the Result:

4.1.Ordinary Least Square Technique:

Table: 1: Result of OLS Technique

Variable	Dependent variable is LnGDP				
	Coefficient	SE	t ratio	R^2	F Statistic
Ln DEV	0.6723	0.012583	53.43	0.99	5589.34
	Dependent variable is LnDEV				

LnGDP	0.7510	0.014056	53.43	0.94	5589.34

Ho: There is no relationship between the variables; H_1: There is relationship between the variables

Table 2: Unit Root Test: The Results of the Augmented Dickey Fuller (ADF) Test for Levels with an Intercept and Linear Trend

	Intercept only			Intercept&Trend		
Variable	ADF(0)	ADF(1)	ADF(2)	ADF(0)	ADF(1)	ADF(2)
LnGDP AIC SBC	2.144 -3.665 -3.588	1.359 -3.675 -3.558	1.825 -3.679 -3.521	-1.739 -3.697 -3.582	-1.625 -3.697 -3.542	-1.844 -3.723 -3.525
	1% critical value is -3.571*			1% critical value is -4.163		
Ln DEV AIC SBC	-1.175 -2.816 -2.739	-1.457 -2.805 -2.688	-1.635 -2.761 -2.604	-0.8058 -2.787 -2.671	-0.9472 -2.780 -2.624	-0.7412 -2.728 -2.531
	1% critical value is -3.568			1% critical value is -4.158		

Ho: series has unit root; H1: series is trend stationary
*MacKinnon critical values for rejection of hypothesis of a unit root.
AIC stands for Akaike info criterion
SBC stands for Schwarz Bayesian criterion

Table 3: Unit Root Test: The Results of the Augmented Dickey Fuller (ADF)Test for the First Difference with an Intercept and Linear Trend

	Intercept only			Intercept&Trend		
Variable	ADF (0)	ADF (1)	ADF (2)	ADF (0)	ADF (1)	ADF (2)
LnGDP AIC SBC	-5.29 -3.67 -3.59	-4.48 -3.65 -3.53	-4.49 -3.69 -3.53	-5.55 -3.68 -3.56	-4.99 -3.69 -3.53	-4.96 -3.71 -3.51
	1% critical value is -3.574*			1% critical value is -4.158		
LnDEV AIC SBC	-6.219 -2.800 -2.723	-4.882 -2.743 -2.625	-3.727 -2.692 -2.532	-6.409 -2.801 -2.684	-5.193 -2.758 -2.600	-4.631 -2.693 -2.494
	1% critical value is -3.571			1% critical value is -4.163		

Ho: series has unit root; H1: series is trend stationary.
*MacKinnon critical values for rejection of hypothesis of a unit root.
AIC stands for Akaike info criterion
SBC stands for Schwarz Bayesian criterion

Table 4: Johansen Cointegration Tests:

Hypothesized N0. Of CE (s)	Eigen value	Likelihood Ratio	5% critical value	1% critical value
None **	0.394976	31.16374	19.96	24.60
At most 1	0.136497	7.044376	9.24	12.97

Ho: has no co-integration; H1: has co-integration.
*(**) denotes rejection of the hypothesis at 5%(1%) significance level
L.R. test indicates one cointegrating equation(s) at 5% significance level

In Ordinary least Square Method, we reject the hypothesis that there is no relationship between the variable and the results of the Ordinary Least Squares Method suggests that there is positive relationship between DEV and GDP and vice versa.

4.2.Unit Root Test

Table 2&3 present the results of the unit root test. The results show that both variables of our interest, namely LnGDP and Ln DEV attained stationarity after first differencing, I(1), using ADF Test.

Table (2) presents the results of the unit root test for the two variables for their levels. The results indicate that the null hypothesis of a unit root can not be rejected for the given variable and, hence, one can conclude that the variables are not stationary at their levels.

To determine the stationarity property of the variable, the same test above was applied to the first differences. Results from table (3) revealed that the ADF value is greater than the critical t-value at 1% level of significance for all variables. Based on these results, the null hypothesis that the series have unit roots in their differences is rejected, meaning that the two series are stationary at their first differences [they are integrated of the order one i.e I(1)]. The AIC (Akaike Information criterion) and SBC (Schwartz Bayesian criterion) are shown in the tables to determine the number of lags that makes the error term a white noise, which is one lag, as can be seen from table (3).

4.3.Cointegration Test:

Having established the time series properties of the data, the test for presence of long-run relationship between the variables using the Johansen and Juselius(1992) LR statistic for cointegration was conducted. The crucial approach which is used in this study to test cointegration is called the Johansen cointegration approach. The Johanson approach can determine the number of cointegrated vectors for any given number of non-stationary variables of the same order. The results reported in table (4) suggest that the null hypothesis of no cointegrating vectors can be rejected at the 1% level of significance. It can be seen from the Likelihood Ratio (L.R.) that we have a single co-integration equations. In other words, there exists one linear combination of the variables.

The normalized cointegrating equation is

$$LnGDP = -14.65 + \underset{(0.3721)}{0.9456}\, LnDEV \quad (7)$$

The standard error is in the parentheses the behavioural parameter(DEV) is statistically significant at 5%.

Estimating the long-run relationship, the results are contained in equation (7) which shows positive relationship between government's developmental spending education and economic growth. Precisely, 1% increase in developmental expenses of government raises the level of GDP by 94.56%.Therefore, the Normalized cointegration equation reveals that there is a positive relationship between developmental expenditure of government (DEV) and GDP(Economic growth).Looking at the results, the normalized cointegrating equation (7) reveals that in the long-run, Developmental expenditure of government affects economic growth positively in India. Interestingly, this result is impressive because 1% change in govt. expenses leads to about 95 percent change in economic growth via GDP growth in the same direction, over the long-run horizon. This of course is highly significant judging from the t-statistic.

4.4.Granger Causality Test :

The results of pair wise Granger Causality between economic growth (GDP) and developmental expenditure of government (DEV) are contained in Table 5. The results reveal the existence of a bi-directional causality which runs from economic growth (GDP) to developmental expenditure of government (DEV) and vice versa.

Table: 5: Granger Causality test

Null Hypothesis	Lag	Observations	F-statistics	Probability	Decision
LnDEV does not Granger Cause LnGDP	1	49*	0.3776	0.5248	Accept
	2	48	0.1567	0.8482	Accept
	3	47	0.2367	0.8716	Accept
	4	46	0.2683	0.8974	Accept
LnGDP does not Granger Cause LnDEV	1	49	0.00027	0.9772	Accept
	2	48	1.9111	0.1692	Accept
	3	47	1.5378	0.2204	Accept
	4	46	1.8543	0.1406	Accept

*Observations. after lag.

Table: 6:Short term causality test for time series data(VECM)

variable	Model-1 D(LnGDP)	Model-2 D(LnDEV)
ECM	-0.022109* (0.00464) (-4.764)	-0.013246* (0.00387) (-3.423)
D(LnGDP(-1))	0.295030 (0.13866) (2.127)	0.368700 (0.24933) (1.478)
D(LnGDP(-2))	-0.176615 (0.15254) (-1.15780)	0.127462 (0.25284) (0.50412)
D(LnDEV(-1))	0.000682 (0.09703) (0.00702)	0.092663 (0.16083) (0.57616)
D(LnDEV(-2))	-0.048089 (0.09501) (-0.50616)	-0.032624 (0.15748) (-0.20717)
R-squared	0.5198	0.318
F-statistic	3.236361	3.390904

- indicates panel data pass the significance test by 95% level,

The null hypotheses of the Granger-Causality test are:

H0: X ≠ Y (X does not granger-cause Y)
H1: X ≠Y (X does Granger-cause Y)

We have found that both for the Ho of "LnDEV does not Granger Cause LnGDP" and Ho of "LnGDP does not Granger Cause LnDEV", we cannot reject the Ho since the F-statistics are rather small and most of the probability values are close to or even greater than 0.1 at the lag length of 1 to 4. Therefore, we accept the Ho and conclude that LnDEV does not Granger Cause LnGDP and LnGDP does not Granger Cause LnDEV.

The above results generally show that there does not exist any causality between developmental expenditure of government and economic growth in India in short run.

4.5.Error Correction Mechanism(VECM):

The result (Table 6) indicates that the ECM in model-1 tested by equation (6) is positive and passes the significance test by 0.05, which means error correction happens, and the pulling function of education expenses on GDP is proved. The ECM in model-2 tested by equation (7) is positive and passes the test, which means that there exists mutual causality between developmental expenditure of government (DEV) and GDP. According to the co-integration equations, we can see they are positively related. That is to say, developmental expenditures of government have positively pulling function on GDP; on the other hand, the GDP growth will also promote the DEV. So it can be concluded that developmental expenditure of government and GDP are mutually causal.

5. Conclusion

The paper tries to assess empirically, the relationship between developmental expenditure of government and economic growth in India using annual data over the period 1961-62 to 2009-10. The unit root properties of the data were examined using the Augmented Dickey Fuller test(ADF) after which the cointegration and causality tests were conducted. The error correction models were also estimated in order to examine the short –run dynamics. The major findings include the following:

The unit root test clarified that both economic growth and developmental expenditure of government are non-stationary at the level data but found stationary at the first differences.Therefore,the series of both variables of our consideration-DEV and GDP, namely, developmental expenditure of government and economic growth were found to be integrated of order one using the ADF tests for unit root.

The cointegration test confirmed that economic growth and developmental expenditure of government are co integrated, indicating an existence of long run equilibrium relationship between the two as confirmed by the Johansen cointegration test results.

The Granger causality test finally confirmed the absence of any kind of short run causality between economic growth and developmental expenditure of government which can neither support Keynesian approach nor Wagner's law simultaneously.

The error correction estimates gave evidence that developmental expenditure of government (DEV) and GDPgrowth are mutually causal.

Finally, the study does not support the existence of Keynesian hypothesis that growth in government's developmental expenditures cause economic growth and also indicates that Wagner's law of fiscal activism is invalid in India.

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