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# **Causal Link between Central Government Revenue and Expenditure: Evidence for India**

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## **Abstract**

This paper attempts to analyze the causal relationship between central government revenue and expenditure for India using annual data over the period 1970-2008. The Johansen cointegration test suggests that there is a long-run relationship between central government revenue and expenditure. The result from Granger causality test based on Vector Error Correction Models (VECM) suggests bidirectional causality between central government revenues and expenditures in the long-run supporting Fiscal Synchronization hypothesis. Under this hypothesis, our finding indicates that the fiscal authority of India should try to raise revenue and cut expenditure simultaneously in order to control the respective fiscal deficit. The short-run Granger causality test based on WALD test restriction suggests unidirectional causality from expenditure to revenue supporting “Spend-and-Tax” hypothesis. This hypothesis suggests that the unsustainable fiscal imbalances can be mitigated by policies that adjusted government expenditure.

*Keywords:* Revenue, Expenditure, Deficit, Causality, Cointegration

*JEL Classification:* H2, H5, H62, C22, C32

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## **Causal Link between Central Government Revenue and Expenditure: Evidence for India**

### **1. Introduction**

Developing countries are facing dual challenges while planning and implementing fiscal adjustment policies. One arises from the increasing demand for public expenditure for infrastructure and social sector investment, and the other arises from the lack of capacity to raise revenue from domestic sources to finance the increased expenditure, primarily due to low per capita income and narrow tax base. To boost the competitive capacity of the country in a rapidly globalizing world, the governments of developing countries have to invest a large portion of their revenue in building physical infrastructure. In addition, the low income developing countries also need to spend a major portion of their development expenditures in providing social services to the poor, such as health, education, etc. On the other hand, as Khattry (2003) pointed out, “the structural characteristics of low income countries, combined with prevalence of unsophisticated tax administration limit their ability to raise taxes from domestic sources, namely income and domestic indirect taxes”. In addition, the existence of a large informal sector and the underground economy constrains the government’s capacity for revenue growth.

Fiscal policy is the instrument by which a government adjusts its levels of spending in order to monitor and influence a nation’s economy. The nature and objectives of fiscal policy may differ with the level of development of the countries. Long-run outcome of expansionary fiscal policy depends on the nature of distribution of public resources, as the same amount of public money can generate different growth pay-offs in different sectors. When the government takes expansionary fiscal policy (expenditure exceeds revenue) and the resulting deficit can be interpreted as a means to finance additional government expenditure. If these additional expenditures are considered as growth enhancing, then a government deficit exhibits an indirect effect on

long-term economic growth. According to Keynesian economic theories, running a fiscal deficit and increasing government debt can initially stimulate economic activity only when a country's output (GDP) is below its potential output. But when an economy is running near or at its potential level of output, fiscal deficits can cause high inflation. At that point fiscal deficit must be controlled.

Understanding the relationship between revenue and expenditure is a crucial prerequisite for any effective fiscal consolidation process. The fiscal deficit can be reduced via changes in government expenditures, or revenues, or both. The selection of any of these approaches should be based on the outcome of empirical investigation. On the revenue side, taxes have the potential to distort private agents' decisions with respect to factor accumulation and supply (Carneiro et al., 2004). On the other hand, public expenditure reflects the policy choices of government. Once governments decide which goods and services to provide, and the quantity and quality in which they will be produced, public expenditure represents the cost of carrying out these policies.<sup>1</sup>

The discussion of the causal link between revenue and expenditure has resulted in several hypotheses. The Tax-and-Spend hypothesis postulates that governments raise tax revenues ahead of engaging in new expenditures (Friedman, 1978; Buchanan and Wagner, 1977, 1978). The Spend-and-Tax hypothesis, on the other hand, predicts that governments spend first and then increase tax revenues to finance their expenditures (Peacock and Wiseman, 1979; Barro, 1974). There is also the Fiscal Synchronization hypothesis, which suggests that governments take decisions about revenue and expenditure simultaneously (Musgrave, 1966; Meltzer and Richard, 1981). Finally, a fourth hypothesis mentioned by Baghestani and McNown (1994) and highlighted by

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<sup>1</sup> For instance, Barro (1990), Romer (1990), and Bloom et al. (2001) argued that expenditure items such as public infrastructure, research and development, education, and health could have positive impact on growth.

Darrat (1998) relates to the institutional separation of the expenditure and revenue decisions of government. Here, expenditure would be defined on the basis of the requirements expressed by the citizenry and revenue would depend on the maximum tax burden tolerated by the population.

Indian Fiscal policy during the 1970s consciously focused on achieving greater equity and social justice through both taxation and expenditure policies. Accordingly, income tax rates were raised to very high levels, with the maximum marginal rate of income tax moving up to 97 per cent and, together with the incidence of wealth tax, it even crossed 100 per cent. Over the years, in addition to the commitment towards a large volume of developmental expenditure, the Government's expenditure widened to include rising subsidies. Large interest payments on growing debt and downward rigidity in prices further contributed to increased current expenditure. Considerable fiscal deterioration took place during the 1980s and eventually became unsustainable, though the growth rate did rise significantly with enhancement in public investment in infrastructure. During this phase, expenditure of the government was seen as an instrument having a bearing upon aggregate demand, resource allocation, and income distribution. The government sought to reduce its deficit through increase in taxes.

The fiscal imbalances of the 1980s in India spilled over to the external sector resulting in the macroeconomic crisis of 1991. Another disquieting feature of the fiscal system was the large size of monetised deficit, which in turn exerted inflationary pressures. The reforms aimed at augmenting revenues and removing anomalies in the tax structure through restructuring, simplification, and rationalisation of both direct and indirect taxes. The Central Government of India, through the enactment of the Fiscal Responsibility and Budget Management (FRBM) Legislation in August 2003, set for itself a rule-based fiscal consolidation framework. Expenditure Reform Commissions set

up by the Government also suggested a host of measures to curb built-in-growth in expenditure and to bring about structural changes in the composition of expenditure.

Looking these factors into consideration, the focus of this paper is to examine the inter-temporal causal relationship between Real Central Government Revenue (RGR) and Real Central Government Expenditure (RGE) and its policy implications for managing fiscal deficit in India. We empirically examine the validity of these hypotheses with refers to the case of India. Utilizing Johansen cointegration analysis and VECM, inferences can be drawn after the empirical evaluations concerning to the respective hypothesis. After this idea regarding the causal link between central government revenue and expenditure with refers to India, the rest of the paper has been organised as follows. Section 2 explains the theoretical and empirical review of the relationship between public expenditure and revenues as tested by various researchers. Section 3 describes the fiscal position in India. Section 4 discusses the methodology and the data used in this analysis. Empirical results are reported in section, 5 while section 6 provides concluding remarks and gives some policy implications for India.

## **2. Review of Literature**

There are four possible hypotheses regarding the relationship between revenue and expenditure. First, Tax-and-Spend hypothesis advanced by Friedman (1978), argues that the change in government revenues lead to change in government expenditures. Friedman (1982), re-emphasized his previous argument by suggesting that budget deficit cannot be reduced by simply raising taxes as this only results in more spending, leaving the deficit at highest level acceptable by the public. Buchanan and Wagner (1977, 1978) advanced an alternative version of the Tax-and-Spend hypothesis. In contrast to Friedman (1978), they argue that increase in tax lead to spending cut in expenditure. The thrust of the Buchanan and Wagner (1977, 1978) version of the Tax-and-Spend

hypothesis is that taxpayers suffer from the fiscal illusion. According to their views, tax cut lower the perceived price of government goods and services which has been provided by government to the public, and further, it can increase the public demand for these goods and services. However, the public may actually incur even higher costs; a direct consequence of indirect inflation taxation that results if the government resorts to excessive money creation coupled with the fact that government debt financing is normally associated with higher interest rates, which crowd out private investment. To reduce expenditures, Buchanan and Wagner (1977) favour in limiting ability of the government to resort to deficit financing. In sum, while tax change is anticipated by Friedman drive to change in spending. The relationship between these two factors as postulated by Buchanan and Wagner is an inverse one.

Second, the Spend-and-Tax hypothesis suggests that changes in government expenditures lead to the changes in government revenues. Peacock and Wiseman (1979) argue that temporary increases in government expenditures due to “crises” can lead to the permanent increases in government revenues, often called as the “displacement effect”. Utilizing the Ricardian equivalence proposition by Barro (1974) argues that government borrowing today results in an increased future tax liability, which is fully capitalized by the public. Thus, under Barro’s analysis, fiscal illusion is absent refers to the increase in government spending lead to the increase in taxes.

The third kind of relationship that may appear between these two variables is defined as fiscal synchronization hypothesis, which suggests that revenue and expenditure are determined simultaneously. This argument is mainly developed by Musgrave (1966) and Meltzer and Richard (1981). According to them, government expenditure and revenue are determined in the process of equalizing marginal benefit to the marginal cost of government services by the population of the country.

The fourth hypothesis, mentioned by Baghestani and McNown (1994) and highlighted by Darrat (1998), relates to the institutional separation of the expenditure and revenue decisions of the government. Here, expenditure would be defined on the basis of requirements expressed by the citizenry and revenue would depend on the maximum tax burden tolerated by the population. As a result, the achievement of fiscal equilibrium would merely be a matter of coincidence. The empirical literature on the tax-and-spend debate has gained mixed results, based on the various time periods analysed, specification of the lag length used, and methodology employed. Generally, the methodology used in these studies has been to test for granger causality within a vector autoregressive (VAR) model; however, some of the studies test for granger causality within an error-correction framework.

In the case of the United States of America, Blackley (1986), Ram (1988a), Bohn (1991), and Hoover, and Shefrin (1992) provide evidence to support the Tax-and-Spend hypothesis, while Anderson et al. (1986), Von Furstenberg et al. (1986), Jones and Joulfain (1991), and Ross, and Payne (1998) find support for the spend-tax hypothesis. Manage and Marlow (1989), Miller and Russek (1990), and Owoye (1995) suggest that the fiscal synchronization hypothesis is valid for the USA while Baghestani and McNown (1994) support the institutional separation hypothesis.

In the case of Canada, the studies by Ahiakpor and Amirkhalkhali (1989) and Payne (1997) support the Tax-and-Spend hypothesis while the evidence of Owoye (1995) supports the fiscal synchronization hypothesis. Regarding the remaining G7 countries,<sup>2</sup> Owoye (1995) finds the Tax-and-Spend hypothesis is valid for Italy and Japan, while the fiscal synchronization hypothesis is supported in France and the United Kingdom. In a study of OECD countries, Joulfain and Mookerjee (1991) find support for

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<sup>2</sup> The G7 countries include: Canada, U S A, France, Italy, Japan, U K, and Germany



the Tax-and-Spend hypothesis in Italy and Canada; support for the Spend-and-Tax hypothesis in the USA, Japan, Germany, France, United Kingdom, Austria, Finland, and Greece; and support for the fiscal synchronization hypothesis in Ireland.

In the case of Latin American countries, Ewing and Payne (1998) find evidence of a bi-directional causality between revenues and expenditures supporting the fiscal synchronization hypothesis in Chile and Paraguay. For Colombia, Ecuador, and Guatemala, they find evidence of causality from revenues to expenditures supporting the Tax-and-Spend hypothesis. Baffes and Shah (1990, 1994) on their part, find that for Brazil, Mexico, and Pakistan, strong bidirectional causality exists between revenues and expenditures, while for Argentina and Chile expenditures appear to cause revenues, supporting the Spend-and-Tax hypothesis.

With refers to Greece, Provopoulos and Zambaras (1991), as well as Hondroyiannis and Papapetrou (1996), provide evidence of the Spend-and-Tax hypothesis, while Katrakilidis (1997) finds evidence in favour of fiscal synchronization. Ram (1988b) examines twenty two countries, comprising both developed and developing countries. Using constant price measures of revenues and expenditures, Ram finds support for the Tax-and-Spend hypothesis in El Salvador, Philippines, Thailand, and in United Kingdom; support for Spend-and-Tax hypothesis in Honduras and New Zealand; and support for the fiscal synchronization hypothesis in Nicaragua. The remaining eighteen countries display an absence of causality in either direction, thus, lending support for the institutional separation hypothesis.

For South Africa, Nyamongo et al. (2007) investigate the relationship between revenue and expenditure in the context of VAR approach and conclude that revenue and expenditure are linked bi-directionally in the long-run, indicating fiscal synchronization hypothesis, while no evidence of causality is seen in the short-run, which points to fiscal

separation hypothesis. On their part, Carneiro, et al. (2004) study the relationship between government revenue and expenditure in Guinea Bissau using Granger causality test and error correction and conclude that expenditures granger cause revenues, which indicates Send-and-Tax hypothesis for Guinea Bissau.

### **3. Fiscal position in India**

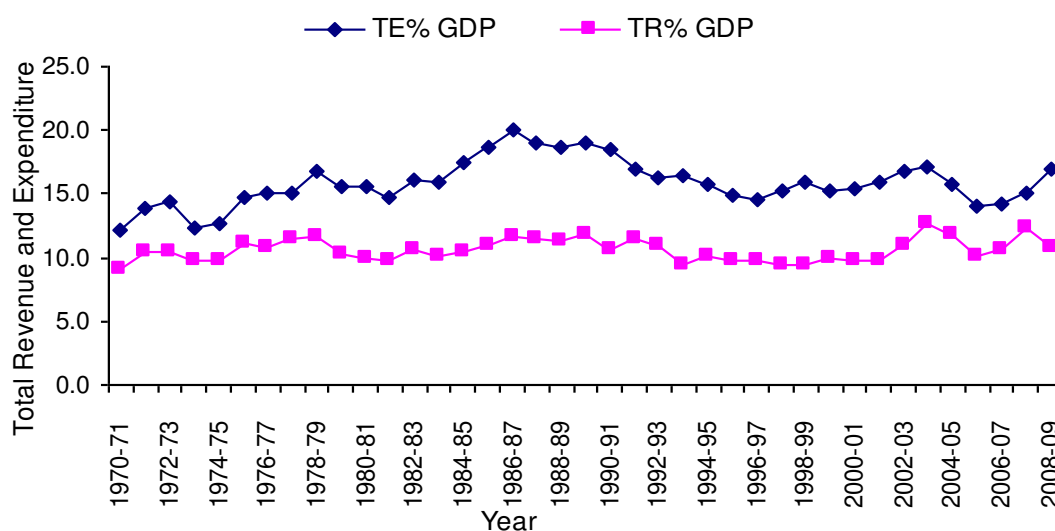
The fiscal trend of the 1970s suggests that this was a period of moderate growth in public expenditure. The break came during the 1980s, when the total expenditure of the Central Government increased from 15.7 per cent of GDP in 1980–81 to 18.5 per cent in 1990–91. This was mainly due to the increase in non-plan expenditure, which climbed from 5.7 per cent of GDP during 1980–81 to 8.6 per cent during 1990–91. There is increase in all categories of non-plan revenue expenditure, namely interest payment, defence expenditure, subsidies, and other non-plan revenue expenditure in this period. The capital expenditure increased from 5.4 per cent of GDP in the 1970s to 5.6 per cent in the 1990s. Thus, it is clear that the period 1990s were characterized by a significant increase in government expenditure, both plan and non-plan as revenue and capital expenditure. Parallel to the increase in expenditure, the total receipts of the Central Government also went up from 10 per cent of GDP in 1980–81 to 10.7 per cent in 1990. As the base of direct taxes comprising of corporate tax and income tax was quite low; the buoyancy in tax revenue was experienced mainly due to an increase in indirect taxes. The increase in indirect taxes came mainly from customs duty, which went up from 2.3 per cent of GDP in the 1980s to 3.6 per cent in the 1990s. This happened due to both an increase in the levels of customs duty (average tariff reached nearly 110 per cent towards late-1980s) and an increase in imports (result of the first wave of liberalization during the 1980s). Thus, the second half of eighties witnessed a rather disturbing trend on the external front. While on the one hand imports increased due to gradually liberalizing policies, export

competitiveness of the country got eroded due to higher customs duties, creating a mismatch in the trade account. What is worth noting for the decade of 1990s, is that while the government expenditure and revenue both grew substantially, the growth in revenue could not keep pace with the growth in expenditure. The expenditure/GDP ratio was nearly 18.5 per cent in 1990–91 and the total receipts/GDP ratio was 10.7 per cent for the same period. This not only widened the resource gap, but also resulted in growing public debt and a higher fiscal deficit.

However, since the fiscal expansion relied heavily on public debt, interest payments, and debt servicing increased over the period from 1970 to 1990. In fact, the interest payment became the largest component of the Central Government non-plan expenditure during the second half of the 1980s overtaking the defence expenditure. Fiscal correction became inevitable to deal with the crisis. The economic reforms that were initiated post-crisis indeed focussed on fiscal adjustment and consolidation, elimination of automatic monetization of fiscal deficits, and reform in taxation and investment policies. Consequently, the total expenditure of the Central Government as a percentage of GDP did show a sign of decline from 18.5 during 1990–91 to 15.9 per cent during 2001–02 and, thereafter, went up again to 16.8 per cent during 2002–03. Interestingly, both plan and non-plan expenditures, as also the revenue expenditure followed the same pattern. Another striking aspect of the public expenditure of the post-reform period is that even the different categories of non-plan expenditure firstly showed a decline during 1990s and then increased for the period 2003–04, with the exception of interest payment, which continued to increase from 1970 to 2008. In fact, interest payment is now the largest component of non-plan expenditure. This is clearly a pointer to the fact that the structural character acquired by public expenditure in India has been a critical factor underlying the fiscal imbalances throughout the 1990s, and even now. The

total expenditure of the Central Government has declined from 18.5 per cent of GDP in 1990–91 to 14.1 per cent in 2005–06. Both revenues and capital components of expenditure have declined during this period. Most importantly, the share of capital expenditure in total expenditure declined sharply from 25.7 per cent in 1990–98 to 17.0 per cent in 2004–07, though this happened partly because of the cessation of loans from the Central Government to states, which were classified as capital expenditures. However, the decline in capital expenditure does suggest some moderation in public investment over the period, which has contributed to the lower than desirable growth in infrastructure investment since the mid-1990s. Figure 1 shows the trends of total expenditure and total revenue of the Central Government in terms of GDP.

Figure 1-Total Revenue and Expenditure of the Centre (Rs in Crore)



Source: The Handbook of Statistics on Indian Economy, Reserve Bank of India.

Note: 1 The ratio to GDP at current market price are based on CSO's new 1999–2000 series.

2 TR–Total Receipts, TE–Total Expenditure.

Total expenditure increased from the 1970s to the mid-1980s. The increased government expenditure in the mid-1980s was funded largely through external borrowings, and not through different forms of domestic resource mobilization like taxation. After nineties, both total expenditure and total revenue of the Central Government came down due to

expenditure rationalization. Share of revenue receipts of the central government increased from 1970 to 1990, but after tax reforms, revenue receipts of the centre declined. Capital receipts of the centre continue to decline from 1970 to 2008. Tax revenue, on an average, could finance about 60 per cent of the centre's revenue expenditure during the 1980s. The proportion during 1990s, however, was about 55 per cent, only. Continuing reforms and rationalization of the tax structure has resulted in a structural shift in the composition of tax revenues. A fall in the share of indirect tax collections from 80 per cent of total tax revenue in the 1980s to 70 per cent in the 1990s could not be fully compensated by the increase in direct tax revenue. Overall, non-tax revenue growth has practically stagnated. For the Central Government budget, it was, on average, 2.5 per cent of GDP during eighties and at the same level during the nineties.

#### **4. Data and Methodology**

##### **4.1 Data Issues**

The empirical analysis employed annual data on RGR and RGE for India over the period 1970 to 2008. All data are transformed into their logarithmic form to test the causal relationship among the variables. Refers to the price, the wholesale price index (1999–2000) is chosen to be the price deflator. Data is in real terms, assuming that government takes budgetary decision by taking accounts of the expected level of inflation because inflation affects actual level of expenditure and revenue. All data series are obtained from the Reserve bank of India (RBI) publication of *Hand Book of Statistics on Indian Economy* and various volumes of Economic Survey. Data on Wholesale Price Index (WPI) are obtained from Ministry of Commerce, Government of India. The basic variables for this empirical analysis are Log of Real Central Government Revenue

(LRGR),<sup>3</sup> and Log of Real Central Government Expenditure (LRGE).<sup>4</sup>

## 4.2 Unit Root Test

It is well known that most of economic time series data might have a unit root and dominated by stochastic trend. The presence of a unit root in any time series means that the mean and variance are not independent of time. Conventional regression techniques, based on non-stationary time series produce spurious regression and statistics may simply indicate only correlated trend rather than a true relationship. Since, correct information depends on the stationarity of the data. In order to address the integration properties of the variables, we construct a stationary test using Augmented Dickey Fuller (ADF) test proposed by Dickey and Fuller (1979), and Phillips and Perron (PP) (1988) have proposed a nonparametric method to correct a wide variety of serial correlation and heteroskedasticity. The unit root test and the order of integration would be performed on both the original series and the differences of the series using the ADF and PP test.

## 4.3 Johansen Cointegration

The first step in the empirical estimation is univariate characteristic, which shows that the variables are stationary or non-stationary. If the variables are non-stationary, their order of integration is tested. This paper uses ADF and PP statistics to test the stationarity of the variables and their order of integration. If the variables are I (1), the next step is to test whether they are cointegrated. This is done by using the Johansen (1988, 1995) fully information maximum likelihood estimates. This econometric methodology corrects for autocorrelation and endogeneity parametrically using VECM. The Johansen procedure is described as follows. Defining a vector  $X_t$  of  $n$  potentially endogenous variables, it is possible to specify the data generating process and model  $X_t$

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<sup>3</sup> Revenue of the government consists, revenue receipt (tax revenue and non-tax revenue), recovery of loan and advances and return of PSU disinvestments.

<sup>4</sup> Expenditures of the government consists revenue expenditure (interest payment, subsidies, defense revenue expenditure and wages and salaries) and capital expenditure includes loan and advances, capital outlay and defense capital expenditure.

as an unrestricted VAR involving up to k- lags of  $X_t$  specified as follows:

$$X_t = \mu + A_1 X_{t-1} + \dots + A_{t-k} X_{t-k} + \varepsilon_t \quad (1)$$

Where,  $\mu$  is a constant term which can be divided into two parts, the intercept in the cointegration relation and the trend terms,  $X_t$  is  $(n \times 1)$  matrix of non-stationary I (1) variables and  $A_i$  is an  $(n \times n)$  matrix of coefficients. This is a system in reduced form and each variable in  $X_t$  is regressed on the lagged values of itself and all the other variables in the system. Equation (1) can be re-specified into a VECM as follows:

$$\Delta X_t = \mu + \Gamma_1 \Delta X_{t-1} + \dots + \Gamma_{k-1} \Delta X_{t-k+1} + \Pi X_{t-k} + \varepsilon_t \quad (2)$$

Where,  $\Gamma_i = -(I - A_1 - A_2 \dots - A_i)$ ,  $(i = 1, \dots, k-1)$  and  $\Pi = -(I - A_1 - \dots - A_k)$ ,

$I$  is a unit matrix,  $A_i (i = 1, \dots, p)$  are the coefficient vectors,  $k$  is the number of lags included in the system,  $\varepsilon_t$  is n-dimensional vector of innovations and independently and identically distributed with mean zero and variance  $\delta^2$  and  $\Delta$  represents variables in differenced form which are I (0) and stationary. In the analysis of VAR,  $\Pi$  is a vector which represents a matrix of long-run coefficients. The long-run coefficients are defined as a multiple of two matrices,  $\alpha$  and  $\beta'$  of dimension  $(n \times r)$  and  $(r \times n)$  respectively and  $\Pi = \alpha\beta'$ , where  $\alpha$  is a vector of the loading matrix and denotes the speed of adjustment from the disequilibrium, while,  $\beta'$  is a matrix of long-run coefficient so that the term  $\beta'X_{t-1}$  in equation (2) represents up to  $(n-1)$  cointegration relationship in the cointegration model. It is responsible for making in sure that  $X_t$  converges to their long-run steady-state values. If rank of  $\Pi$  is equal to 'n' then vector of  $X_t$  is stationary. In the other extreme, when rank of  $\Pi$  is equal to zero then the matrix is null and  $X_t$  vector is a non-stationary process. If rank of  $\Pi$  is equal to one, there is single cointegrating vector. When rank of  $\Pi$  is within the range,  $0 < r < n$ , then there are r cointegrating vectors. It is

assumed that  $X_t$  is a vector of non-stationary variables I(1), then all terms in equation (2) which involves  $\Delta X_{t-i}$  are I(0), and  $\Pi X_{t-k}$  must be stationary for  $\varepsilon_t$  is I(0) to be white noise. Two tests statistics are suggested to determine the number of cointegration vectors based on likelihood ratio test (LR): the trace test and maximum eigenvalue test statistics is given below.

The trace test ( $\lambda_{trace}$ ) is defined as:

$$\lambda_{trace}(r) = -T \sum_{i=r+1}^n \log(1 - \hat{\lambda}_i)$$

The null hypothesis is that the number of cointegration vectors is  $\leq r$ , where  $r = 0, 1, \text{ or } 2$  against the alternative hypothesis that the number of cointegration vectors equal to  $r$ . Where,  $\hat{\lambda}_i$  is define as the estimated value of characteristics roots obtained from the estimated  $\Pi$  matrix and T is the number of observations.

The maximum eignvalues test ( $\lambda_{max}$ ) is defined as:

$$\lambda_{max}(r_1, r+1) = -T \sum_{i=r+1}^n \log(1 - \hat{\lambda}_{r+1})$$

Under which test the null hypothesis that the number of Cointegration vectors =  $r$  against the alternative that there are  $r+1$  cointegrating vectors; the null hypothesis  $r = 0$  is tested against the alternative  $r = 1$ , and  $r = 0$  is tested against the alternative  $r = 2$ ; when the two tests produced conflicting results, the maximum eignvalues test is considered since the alternative hypothesis is an equality.

#### **4.4 VECM and Causality Test**

The traditional Granger causality test uses the simple F-test statistics. If time series included in the analysis are 1(1) and cointegrated, the traditional Granger causality test should not be used, and proper statistical inference can be obtained by analysing the causality relationship on the basis of the VECM .Many economic time-series are 1(1),



and when they are cointegrated, the simple F-test statistic does not have a standard distribution. If real government revenue and real government expenditure are cointegrated, then causality must exist at least in one direction. The error correction coefficients, term serve two purposes. They are (i) to identify the direction of causality between real government revenue and real government expenditure, and, (ii) to measure the speed with which deviations from the long-run relationship are corrected by changes in real government revenue and real government expenditure. If the variables are I (1) and cointegrated, then Granger causality procedure can be employed in the VECM and it can be expressed as follows:

$$\Delta RGR_t = C_1 + \sum_{j=1}^p \alpha_{1i} \Delta RGR_{t-j} + \sum_{j=1}^p \beta_{1i} \Delta RGE_{t-j} + \phi_{1t} EC_{t-1} + \mu_t \quad (3)$$

$$\Delta RGE_t = C_2 + \sum_{j=1}^p \alpha_{2i} \Delta RGR_{t-j} + \sum_{j=1}^p \beta_{2i} \Delta RGE_{t-j} + \phi_{2t} EC_{t-1} + v_t \quad (4)$$

Where,  $\mu_t$  and  $v_t$  are uncorrelated error terms and  $E(\mu_t, \mu_{st}) = 0$ ,  $E(v_t, v_{st}) = 0$ ,  $\Delta RGR$  and  $\Delta RGE$  first difference stationary and cointegrated variables and  $EC_{t-1}$  is the lagged values of the error correction term derive from the following cointegration regressions equations (5) and (6). The coefficients of error correction terms capture the speed of the short-run adjustment towards the long-run equilibrium.

$$RGR_t = \delta + \varphi RGE_t + \varepsilon_{1t} \quad (5)$$

$$RGE_t = \alpha + \psi RGR_t + \varepsilon_{2t} \quad (6)$$

Long-run and short-run Granger causality can be tested by using equation (3) and equation (4). Granger causality in the long-run is tested by checking the significant of the parameter of estimates of lagged error correction terms, (standard t-test). Negative and statically significant values of the coefficients of error correction terms indicate the existence of long-run causality. On the other hand, the Granger causality in the short-run

is tested jointly, the significant of the coefficients of lagged explanatory variables in their first differences in equation (3) and (4), respectively. This is performed by using the WALD parameter restriction test.

## 5. Empirical Results

### 5.1 Unit Root Tests

Table 1 presents the result of the ADF and PP tests on each variable in levels and first difference. The unit root test carried out by assuming both constant and linear trend in data. In the case, when variables are in level from, the null hypothesis of nonstationarity cannot be rejected for any of the series, the calculated value is less than the critical value of the test statistics for both series, therefore, and the series are non-stationarity at levels.

Table 1: Unit Root Test

Variables	ADF	$\phi_3$	PP
Levels			
RGR	-2.17	6.58*	-2.72
RGE	-2.64	5.73*	-2.60
First Difference			
RGR	-3.46*	-	-8.57**
RGE	-4.52**	-	-5.13**

\*indicate 10 percent level of significance, \*\*indicates 5 percent level of significance

Applying the same test for first difference variables to determine the order of integration, then critical value is less than calculated value of the test statistics for both the variables. Therefore, we conclude that our variables are integrated of order one I (1). The  $\phi_3$  statistics for our discussed variables are considerably higher than its 10 percent critical value. Therefore, we reject the null hypothesis; and we conclude that all series contain a deterministic time trend. We use the Akaike Information Criterion (AIC) to determine the appropriate lag lengths for real government revenue and real government expenditure.

## 5.2 Cointegration Results

Table 2 and 3 summarize the result of cointegration analysis by using the Johansen maximum likelihood approach employing eigenvalue and trace statistics. Firstly, to determine the appropriate lag length for the VAR system, we estimate an unrestricted VAR model in level form of the series and use Akaike Information criteria (AIC) and Hannan-Quinn (HQC) statistics to choose appropriate lag length in the model. It is observed from the results that it takes 3 lags to get uncorrelated and homoskedastic residual for the VAR system. The cointegration test carried out by assuming linear trend in data, and both an intercept and a trend in the cointegrating equation.

Table 2: Cointegration Result based on Trace Statistic (Rank Test)

Null	Alternative	Trace Statistic	5% critical values
$r = 0$	$r \leq 1$	28.18*	25.87
$r \leq 1$	$r = 2$	9.55	12.51

*Note:* \* Denotes rejection of the null hypothesis at the 5% level, trace statistic indicates 1 cointegrating equation at 5% levels; r indicates the number of cointegration relationship.

Table 3: Cointegration Result based on Maximal Eigenvalue Statistic (VAR Lag =3)

Null	Alternative	Max-Eigen Statistic	5%critical values
$r = 0$	$r = 1$	21.63*	19.38
$r = 1$	$r = 2$	9.55	12.51

*Note:* \* Denote rejection of the null hypothesis at the 5% level, maximal eigenvalue statistic indicates 1 cointegrating equation at 5% levels, r indicates the number of cointegration relationship.

Table 2 shows that there is one cointegrating vector between real Central Government revenue and real Central Government expenditure. The null hypothesis indicating no cointegration,  $r = 0$ , is rejected at 5 percent level since the trace statistics (28.18) exceeds the critical values (25.87). However, we fail to reject the null hypothesis at most one cointegrating equation,  $r = 1$ , since trace statistics (9.55) is lower than the critical value (12.51). Similarly Table 3 shows that there is one cointegrating equation

between real government revenue and real government expenditure. The null hypothesis indicating no cointegration,  $r = 0$ , is rejected at 5 per cent level since the maximal eigenvalue statistics (21.63) exceeds the critical values (19.38). However, we fail to reject the null hypothesis stating only one cointegrating vector  $r = 1$ , since maximal eigenvalue statistics (9.55) is lower than the critical value (12.51). Both trace statistic ( $\lambda_{trace}$ ) and maximal eigenvalue ( $\lambda_{max}$ ) statistics indicate there is at least one cointegrating vector between real government revenue and real government expenditure. Therefore, there is a long-run relationship between real government revenue and real government expenditure. Long-run relationship between these two variables is derived by normalizing on Real Government Expenditure (RGE), reported in the following equation (7) with their t-statistic. Existence of cointegration between these variables, as demonstrated by Granger (1969), is evidence of the causality at least in one direction. The long-run model of real government revenue (RGR) and real government expenditure (RGE) can be specified as follows.

$$RGE = 1.08 RGR + 0.83 Trend \quad (7)$$

(3.45)                      (4.14)

In equation (7), the estimated coefficient of RGR is positive and statistically significant at 5 percent level of testing and the estimated coefficient of the time trend is positive and significant at 5 percent level of testing. Therefore, the estimated coefficient of RGR suggests that 1 percent change in real government revenue leads to a 1.08 percent change in real government expenditure. In terms of fiscal policy, the cointegration result suggests that higher spending, which is eventually leads to higher fiscal deficit. To control fiscal deficit the government should try to reduce the expenditure.

### **5.3 VECM and Long-Run Causality Test**

The Johansen cointegration test shows that there exist one cointegrating vector between real government revenue and real government expenditure means that both variables are causally related at least in one direction. We can use a VECM in order to investigate the short-run dynamics and to assess the direction of Granger causality in both the short and the long-run as well. The inclusion of the error terms in the Granger causality test of equations (3) and (4) enable us to distinguish between the short-run and long-run causality. The optimal lag-length, which is 3, can be derived on the basis of Akaike's information Criterion and Hannan-Quinn (HQC). Table 4 reports the results of the VECM and long-run Granger-causality test. The estimated error correction coefficient ECM (-1) and ECM (-2) is negative and significant in both equations, that indicates the existence of long-run causality between real government revenue and real government expenditure. The high absolute value of the error correction term means that adjustment is varying fast. The result shows that the error correction term based on t-test statistic in the government expenditure equation is significant at 5 per cent level. This implies that in the long-run expenditure is a function of revenue in the cointegrating equation, which means that in the long-run revenue, causes expenditure, which leads to Tax-and-Spend hypothesis.

Table 4: VECM and Long-Run Causality Test

Independent variable	Dependent variable	
	$\Delta RGE$	$\Delta RGR$
$\Delta RGE(-1)$	0.576** (2.256)	0.595** (2.396)
$\Delta RGE(-2)$	-0.236 (-0.842)	0.398 (1.460)
$\Delta RGE(-3)$	-0.009 (-0.032)	0.440 (1.570)
$\Delta RGR(-1)$	-0.416 (-1.088)	-0.896** (-2.410)
$\Delta RGR(-2)$	-0.460 (-1.679)	-1.615** (-6.064)
$\Delta RGR(-3)$	-0.416 (-1.0421)	-0.336 (-0.865)
<b>ECM(-1)</b>	<b>-0.387**</b> <b>(-3.122)</b>	
<b>ECM(-2)</b>		<b>-0.105**</b> <b>(-3.399)</b>
C	0.035 (1.340)	0.069 (2.058)
Adj.R-squared	0.548	0.614
F-statistics	6.896	7.959
Diagnostics Test		
Serial correlation LM(3) Test [p-value]	2.812 [0.421]	3.930 [0.261]
ARCH(3) [p-value]	3.140 [0.370]	1.917 [0.589]
Jarque-Bera Normality Test [p-value]	1.032 [0.591]	0.053 [0.973]

Note: 1. \*Denotes significant at 10% level, \*\* Denotes significant at 5 percent level.

2. t-statistics are in parentheses

We can conclude that expenditure moves to restore equilibrium and takes the brunt of the stock of the system. This result suggests that any deviation of government expenditure from its equilibrium path will be resorted at the rate of 38.7 per cent per year. On the other hand, the estimated error correction term is significant at 5 per cent in government revenue equation. This implies that in the long-run revenue is a function of expenditure in the cointegrating equation, which means that in the long-run expenditure, causes revenue, which leads to Spend-and-Tax hypothesis. We can conclude that revenue moves to restore equilibrium and takes the brunt of the stock of the system. This result

suggests that any deviation of government revenue from its equilibrium path will be resorted at the rate of 10.5 per cent per year. All these results indicate causality of a bi-directional nature in the long-run. This result supports the Fiscal Synchronization hypothesis in India. Under this scenario, the government of India should try to raise revenue and cut expenditure simultaneously in order to control fiscal deficit. Short-run dynamics in the government revenue equation shows that one period lag changes in expenditure are significantly affecting revenue, similarly in expenditure equation lag changes in revenue and are not significantly affecting expenditure. Further, we find bi-directional causality between real government revenues and real government expenditures in the long-run. This empirical result supports the “Fiscal Synchronization” hypothesis, which indicates that tax and spending decisions are made simultaneously by the fiscal authority of India over this sample period from 1970–2008. This result is consistent with our expectation about the India’s fiscal system. The major implication that we draw from our result is that there is continuously increasing fiscal deficits in India due to low budgetary receipts. In order to achieve fiscal sustainability in long-run, the government can adjust both revenue and expenditure simultaneously to control fiscal deficit. The policy implication in the long-run suggested that there is interdependence between government revenue and expenditure in India. The diagnostic statistics indicates that the equation is well specified. The Lagrange Multiplier test based on Breusch-Godfrey test of the residual serial correlation accepts the null hypothesis of no autocorrelation in all equation. In addition, in all equations it appears there is no significant Autoregressive Conditional Heteroskedascity (ARCH) using 3 lags. The statistical test for the normality of the residual shows the acceptance of the null hypothesis.

#### 5.4 VECM and Short-run Causality Test

The short-run Granger causality test is applied on estimated VECM where cross equation restrictions are imposed on the coefficients of the explanatory variable in their first differences in each equations of the vector error correction model.

Table 5: VECM and Short-Run Granger Causality Test

Panel A: $\Delta RGE$ as a Dependent Variable			
Excluded	Chi-sq	DF	Probability
$\Delta RGR$	2.927	3	0.395
All	2.927	3	0.395
Panel B: $\Delta RGR$ as a Dependent Variable			
Excluded	Chi-sq	DF	Probability
$\Delta RGE$	8.485	3	0.037
All	8.485	3	0.037

The Granger causality tests or the block exogeneity test restricts all the lag differences of expenditure to be equal to zero in the revenue equations and restricts all the lag differences of revenue to be equal to zero in the expenditure equations. We can test these restrictions with the help of likelihood ratio test, which follows chi-square distribution. Results of the Granger causality test are reported in Table 5. Here it is clear that we cannot reject the null hypothesis that revenue does not cause expenditure, which has a chi-square value of 2.927 with a probability of 0.395 in the expenditure equation, reported in panel A of Table 5. Again, in panel B, the null hypothesis that expenditure does not cause revenue, we can reject the null hypothesis in the revenue equation, which have chi-square value of 8.485 with a probability of 0.037. The above findings indicate that there is exists unidirectional causality from government expenditure to revenue in the short-run. Therefore, we can say that expenditure leads to revenue in the short-run,



supporting Spend-and-Tax hypothesis in India. Under this scenario, government should try to reduce non-developmental expenditure to control fiscal deficit in India.

## **6. Conclusions and Policy Implications**

This paper applies Johansen cointegration technique and a VECM to test the causal relation between central government revenue and expenditure in India over the period 1970 to 2008. The unit root test based on ADF test proposed by Dickey & Fuller (1979) and Phillips-Perron (PP) test shows that the variables are nonstationarity in levels but stationarity in the first difference with linear trend is accepted for all variables. The Johansen estimation technique of cointegration is to identify one cointegrating vector between these two variables, which suggests that there is a long-run relationship between real Central Government revenue and expenditure. The results from Granger causality test based on the corresponding VECM suggest bi-directional causality between government revenues and government expenditures in the long-run supporting “Fiscal Synchronization” hypothesis. Under this scenario, the government of India should try to raise revenue and cut expenditure to control fiscal deficit in India. The short-run causality test based on WALD test restriction suggest uni-directional causality running from expenditure to revenue supporting “Spend-and Tax” hypothesis in India. Under this scenario, reduced expenditure is the key instrument of the Central Government to control fiscal deficit in India. The increasing in revenue is impossible because of structural constraints of the economy. Therefore, fiscal deficit should be reduced by reducing public expenditure in unproductive sector and at the same time ensuring effective utilization of available resources such as to engender the productivity of labour and capital in the economy. If the economy achieves enhanced economic growth it will be possible to raise revenue from domestic sources.

After this empirical evaluation, the paper has several policy implications to the control of fiscal deficit in India, which are summarized as follows. In order to achieve fiscal sustainability in short-run, the government should try to take following steps. As the first step government expenditure should be re-examined with the view to assess (i) their contribution to an efficient allocation of resources within the economy, and (ii) the potential to finance developmental expenditure such as infrastructure, research and development, education, and health in such a manner that increases revenue to the control fiscal deficit. In order to achieve fiscal sustainability in long-run, the government can adjust both revenue and expenditure simultaneously to control the fiscal deficit in India. On the revenue side, the government cannot raise revenue by increasing taxes on domestic consumption and income due to low per capita income, large informal sector, and lack of administrative capacity to collect potential revenue in a developing country like India that leads to low budgetary receipts; to raise the budgetary receipt first, the government can implement suitable tax policy to increase budgetary receipt. Second, to raise revenue receipt, the Central Government would require that user charges are adequately raised, the tax collection machinery is overhauled to achieve better tax compliance, returns on government investment in PSUs are raised through appropriate pricing policies, eliminating implicit subsidies, and the burden on the fiscal deficit is lowered through phasing out of unviable public sector units. The introduction of VAT can eliminate the practice of competitive tax concessions. Finally, a major adjustment can be done by expenditure reduction in unproductive sector and by effective utilisation of existing resources, and it will be possible to raise taxes from domestic sources and thereby reducing fiscal deficit. Indian fiscal policy should be designed and can be implemented in such a way that it can ensure growth; the government can then be able to raise taxes from the increased income growth. The policy implications in the long-run

suggest that there is the interdependence between government revenue and expenditure in India.

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