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PUBLIC DEBT SUSTAINABILITY IN INDIA: A CO- INTEGRATION APPROACH BASED ON STRUCTURAL BREAKS WITH REGIME SHIFT

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Abstract

In this paper we examine the sustainability of public debt in case of India. We have used combined government data (Centre's and State's government) for a period from 1990 to 2016). For testing the sustainability of debt, we have taken government revenues and expenditure. First we have investigated co-integration between government spending and revenues using ARDL bound testing model. The bound test reveals that there exists no long-run relationship between the variables. Gregory-Hansen and Hatemi-j threshold co-integration test are applied to test the sustainability hypothesis in the presence of regime shift. the result shows that no co-

integration relationship between the variables in case of single structural break, but for two structural break our study confirm existence of co-integration relationship for the given variables. We do not find the long-run coefficients statistically significant for sustainability of public debt.

Keywords: **Debt Sustainability; Government's Revenues and Expenditures; ARDL Bound Test**

JEL code: **C22, C51, H63**

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INTRODUCTION

Governments take public borrowing to meet the gap between their revenues and expenditures. Mostly domestic borrowings are preferred, as it bears fewer burdens than that of external borrowings. If their domestic markets for borrowings are not well developed they move to external borrowings. The continuous rise in government expenditures create high fiscal deficit, which pushes the government to borrow resources from both external and internal sources. Recently the sustainability of debt has been given considerable attention. Fiscal sustainability concern is spread for both the developed and developing nation. For an instance , the preconditions to enter the European monetary union is Maastricht treaty required from a government not to run budget deficit and debt- GDP ratio beyond a point of 3% and 60% of GDP respectively. Indian government tried many times to reduce fiscal deficit, but sustaining a lower fiscal deficit still a challenge for India, mainly due to high unproductive expenditures.

In the case of India, fiscal sustainability got the importance during late 1980s with sharp fiscal deterioration; combined government (centre and state) debt was 52.4% of GDP in 1980-1981. India's government debt grew firstly in 1991-92, when it was 80.1% of GDP and then again 1997-98, when fiscal deficit became 10 percent of

GDP [1]. The public debt scenario of India was not healthy during post economic period, it is worse than in pre-reform period. During post-reform period combined centre and state government's average debt was 79% of GDP [1]. More concern about the sustainability of debt was raised by 12th finance commission in 2004 due to increment in debt more than GDP from 1996 to 2003. Since, 2004 the intensity of concern was reduced due to favorable foreign exchange reserves of around 300 billion US dollar in 2009-10, and economic growth increase by 7.5% per annum from the period of 2004 to 2008. Hence it helped in reducing the fiscal deficit below 4% of GDP by 2007-08. But again fiscal deficit of government of India jumped to over 8% of GDP as expansionary fiscal policy was taken to protect the economy from global financial crisis which further have the concern about fiscal policy sustainability of India.

The amount of public debt in India is so high that burden on each Indian multiplied by 14 times since 1990-1991 to 2104-2015. The growing rate of per capita debt is faster than per capita income. On the basis of data taken by the Ministry of finance, the per capita debt increased at 23% per annum, while per capita income increased at 14% per annum during 2102-13 to 2014-15.

Why is fiscal sustainability or debt sustainability required? Debt sustainability implies that current fiscal policy can be continued. If debt is not sustained, then government's policy is necessary. The failure of debt sustainability is a sign of problem for government in long-run to pay its debt. High debt will be paid in the form of high interest rates, which hinders economic growth.

Many attempts have been taken to manage debt in India, like MTFRPs (Medium Term Fiscal Reform Programs) in 2000-01 and FRBM (Fiscal Responsibility and Budget Management Act) in 2003 but still debt is not controlled. Recently serious concern has been expressed about the sustainability of India's public debt. In this paper we examine the sustainability of India's public debt. We have taken combined debt of centre and state governments in the study and period of study is from 1991 to 2016.

The rest of the paper is designed as follows: Section 2 discusses about earlier

literature available on the present study. Section 3 provides a brief report about India's trend of debt/GDP, Expenditures/GDP and Revenues/GDP. Section 4 provides analytical framework. Section 5 discusses data, estimating models and methodology. Section 6 deals with data analysis and empirical results. Conclusions and policy implications are given in section 7.

LITERATURE REVIEW

Traditionally fiscal sustainability was measured in terms of debt-GDP ratio and policy is considered sustainable, if debt-GDP ratio does not grow over time. There are alternative approaches also to test the sustainability of public debt. In Domar approach rate of growth of GDP must exceed the growth of interest rates. Measuring the sustainability of debt from Domar condition is not reasonable [2]. In order to get reasonable result, the standard approach in the literature being used is Intertemporal Budget Constraint (IBC).

In econometrics debt sustainability is tested by the co-movement between government revenues and expenditures. Non-existence of co-integration between revenues and expenditures are interpreted as lack of sustainability.

Hakkio et al. and Quintos [3,4] have investigated debt sustainability based on government's intertemporal budget constraint, using co-integration between government revenues and expenditures. If there exist a co-integration relationship between government expenditures and revenues debt is said to be sustainable. A Strong sustainability if coefficient of co-integration is equal to one and weak if it is between zero and one. Using this technique many other studies have investigated for co-integration between government revenues and expenditures to test debt sustainability. Buitter and Patel [5] applied intertemporal budget constraint technique showed unsustainable debt for India, Tarawalie and Oshikoya [6] examined that fiscal deficits was weakly sustainable for all the WAMZ (West African Monetary Zones) countries except for Sierra, Lusinyan and Thronton [7] reached at the conclusion that there was weak sustainability for South Africa, Jha and Sharma [8] revealed sustainability of public debt for India, Deyshappriya [9] concluded a

unsustainable fiscal policy for Sri Lanka, Rajan Goyal [10] suggested that policy of centre and state government individually is not sustainable, but weekly sustainable for combined government for India, Abdullah et al. [11] examined that fiscal deficits are sustainable for Malaysia in long-run.

Considering the previous literatures on fiscal sustainability, we reached at the conclusion that only some of the literatures available (Afonso et al. [12], Haider Mahmood et al. [13], Kustepeli et al. [14], Tanner et al. [15]) used structural break test applying co-integration test for government revenues and expenditures.

The studies without considering structural break test likely to be inappropriate result. Our intend in this study is to overcome the weakness by using co-integration tests for single structural break and two structural breaks given by GH (Gregory & Hansen) and Hatemi-j (HJ) respectively.

The aim of the study is to test the following major objectives.

- To test the public debt sustainability for India.
- To examine the long-run relationship between government revenue and expenditure as well as strength of relationship.

SOME FACTS ABOUT INDIA'S FISCAL POSITION

Mainly the evaluation of debt in India started from 1951. There is four distinct phases of debt up to now. Period from 1968 to 1974 and 2005 to 2016 showing downward trend, while the period from 1952 to 1968 and 1974 to 2004 showed upward trend in debt/GDP ratio.

Figure 1 shows the trend of debt as a percentage of GDP from 1990-91 to 2016-17 and Figure 2 showing trend of government's revenues and expenditures. Figure 2 reveals that expenditures are continuously greater than receipts.

Figure 1: Debt as a Percentage of GDP.

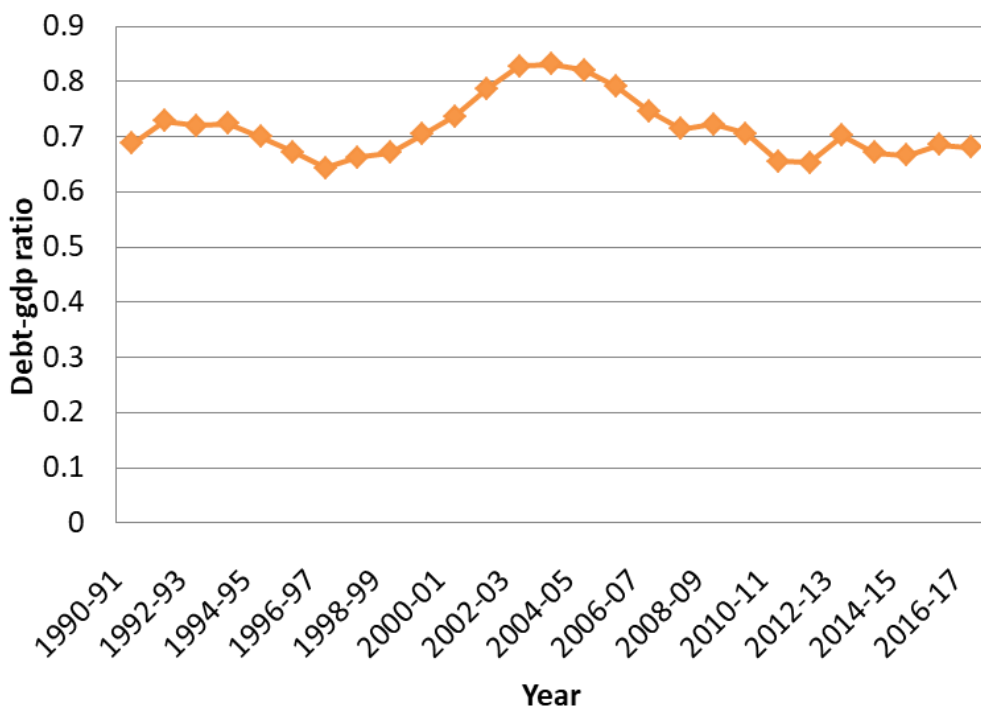
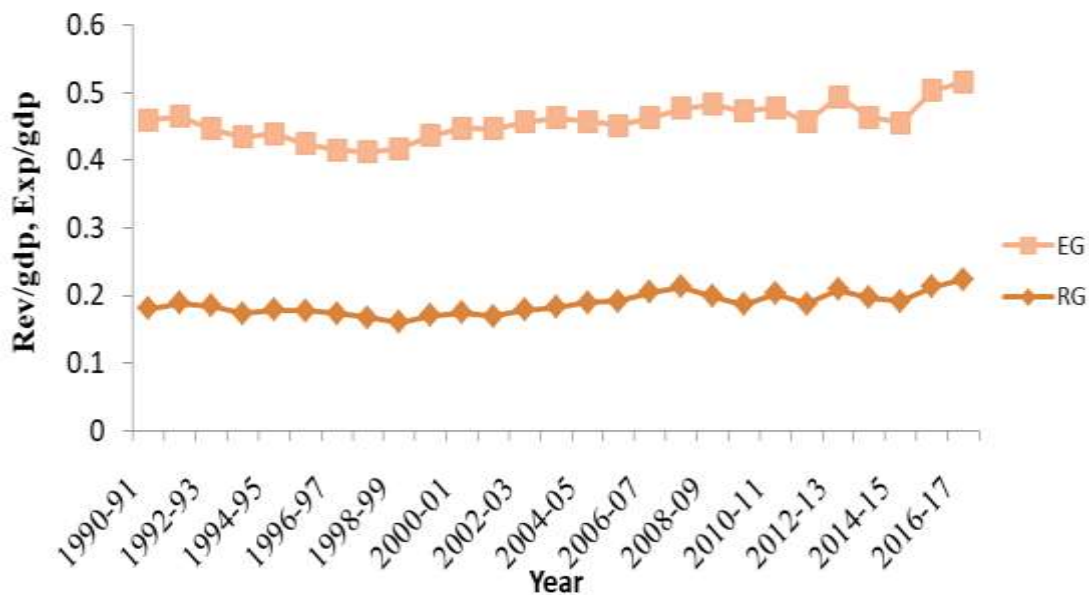


Figure 1: Movement of Revenues and Expenditures.



THE ANALYTICAL FRAMEWORK

The concept of sustainability of debt implies the fulfillment of intertemporal budget constraint condition. It means in the long-run the market value of government debt must be equal to present value of debt. In the violation of above condition fiscal policy is not sustainable. Budget constraint in the equation form may be written as below.

$$g_t + (1+i_t)b_{t-1} = r_t + b_t \quad (1)$$

Where g_t is the expenditures without interest payment, R_t is the government revenues with seignior age, i_t is the interest rate, b_t is the level of debt.

Furthermore, size of the economy is not considered in given variables in the eqn. (1). Therefore to take into consideration the economy size GDP ratio of the given variables are required.

$$\frac{g_t}{Y_t} + \frac{(1+i_t)b_{t-1}}{(1+\rho_t)Y_{t-1}} = \frac{r_t}{Y_t} + \frac{b_t}{Y_t} \quad (1.1)$$

Where, Y_t is nominal GDP and ρ_t is growth rate of nominal GDP. Ratio of the GDP is represented in the following capital letters.

$$G_t + \frac{(1+i_t)}{(1+\rho_t)} B_{t-1} = R_t + B_t \quad (1.2)$$

Now subtracting and adding ρ_t in term $(1+i_t)$ in eqn. (1.2)

$$G_t + \frac{(1+i_t + \rho_t - \rho_t)}{(1+\rho_t)} B_{t-1} = R_t + B_t \quad (1.3)$$

$$G_t + \frac{(1+\rho_t) + (i_t - \rho_t)}{(1+\rho_t)} B_{t-1} = R_t + B_t \quad (1.4)$$

$$G_t + \frac{(1+\rho_t)}{(1+\rho_t)} B_{t-1} + \frac{(i_t - \rho_t)}{(1+\rho_t)} B_{t-1} = R_t + B_t \quad (1.5)$$

$$G_t + B_{t-1} + \frac{(i_t - \rho_t)}{(1 + \rho_t)} B_{t-1} = R_t + B_t \quad (1.6)$$

Following results are derived with the help of algebra:

$$G_t + (i_t^* - i^*)B_{t-1} + (1 + i_t^*)B_{t-1} = R_t + B_t \quad (1.7)$$

Where, $i_t^* = (i_t - \rho_t) / (1 + \rho_t)$ which is growth adjusted interest rate, i^* is the average of i_t^* that is equivalent to $(1 + \rho_t) / (i_t - \rho_t)$.

Now here if, $G_t + (i_t^* - i^*)B_{t-1} = w_t$, the eqn. (1.7) can be written as given below.

$$w_t + (1 + i_t^*)B_{t-1} = R_t + B_t \quad (1.8)$$

Assuming budget constraint continuously at each time t next substitution is written as:

$$B_{t-1} = \sum_{j=t+1}^{\infty} \left(\frac{1}{1 + i^*} \right)^{j-t} (R_{j-1} - W_{j-1}) + \lim_{j \rightarrow \infty} \left(\frac{1}{1 + i^*} \right)^{j-t} B_{j-1} \quad (1.9)$$

If, expectations condition are imposed on available information at time t. Because B_{t-1} is identified at time t that is the hypothesis government follows as its budget constraint written as following.

$$\lim_{j \rightarrow \infty} F_t \left(\frac{1}{1 + i^*} \right)^{j-t} B_{j-1} = 0 \quad (1.10)$$

Therefore, this does not show Ponzi game rule which describes public debt to GDP ratio should not increase more rapidly than interest rate. Principal amount of debt and interest cannot be financed for an indefinite time with new debt. Moreover the amount of public debt is required to wipe out by all present and expected discounted future surpluses.

The method to examine the sustainability of public debt implicates testing the long-

run relationship in the below given eqn. (1.11).

$$R_t = \varphi + \gamma G_t + u_t \quad (1.11)$$

Where R_t and G_t shows government's revenue and expenditures including the interest payment on public debt. For the debt sustainability the co-integration relation between government revenues and expenditures is used. The coefficient of expenditures plays an important role to determine the degree of debt sustainability.

If, $\gamma=1$ means strong sustainability of debt if γ is between zero to one leads to weak sustainability of debt. Eqn. (1.11) has been used as the source for checking sustainability conditions of government intertemporal budget constraint [4,16,17].

DATA AND ECONOMETRIC METHODOLOGY

Data

We have the time series data on combined centre and state government's revenues and expenditures as a percentage of GDP at current price. The data on all the variables are in rupee billion and sources of data is handbook of Indian statistics. All the variables have been converted into log form.

Model: The long-run relationship between total expenditures and total revenues shows public debt sustainability based on intra-temporal public budget constraint. As given in the following equation.

$$LRG_t = \varphi + \gamma LEG_t + u_t \quad (2)$$

Where, t=Time period, 1,2,3....n and u_t is error term at period t, LRG_t and LEG_t are government' total revenues and expenditures in log form respectively.

Unit root test: In the present study, as we are using time series data, therefore it is compulsory to check the unit root, to prove whether the series are stationary or non-

stationary, in order to evade the spurious regression. Since here we have applied ADF-test, PP-test, and KPSS-test of unit root. In case of ADF and PP-test the null hypothesis is that variables are non-stationary and for KPSS-test the null hypothesis is that variables are stationary.

Co-integration methodology: As in case of conventional tests of co-integration of Engle et al. [18] and Johansen et al. [19] which have been used widely in empirical research to examine the long-term relationship of variables especially in a bivariate or multivariate framework .one of the drawbacks of conventional co-integration is that, it is not used when variables are integrated at different order like I (0), and I (1). To overcome this problem, we used ARDL bounds tests approach for co-integration given by Pesaran et al. [20]. ARDL (Autoregressive Distributed Lag Model) model can be used when variables are not integrated at same order. ARDL Model also has the advantages of simultaneous estimation of long-run and short-run parameters in a model. Checking the stationary of the variables (LRG and LEG), we found different order of integrity. LRG is stationary at first difference at 1% level of significance while LEG is stationary at level at 5% level of significance in ADF test, so we used ARDL bound approach for co-integration.

Since ARDL model of co-integration also have the drawbacks, it was assumed in ARDL model that co-integration relationship does not change over the entire period of study which is not realistic when series is long. In long-run structural break is a common phenomenon, if break is found our result using ARDL model would be misleading as co-integration relationship are changed in the presence of structural break. Gregory-Hansen [21] and Hatemi-J [22] for co-integration relationship argued about the structural break test. So here in our study to avoid the misleading result, we use ARDL bound test technique followed by GH and HJ co-integration test based on single and two structural breaks respectively.

TEST FOR CO-INTEGRATION ARDL BOUND TEST

In ARDL model we use the lag values of the dependent variable and the lagged and

contemporaneous values of the exogenous variables. Short-run effects are directly estimated, and the long-run equilibrium relationship indirectly estimated as ARDL technique involves error correction term. The model is written as following.

$$\Delta LRG_t = \alpha_0 + \sum_{i=1}^n \beta_{1i} \Delta LRG_{t-i} + \sum_{i=0}^n \beta_{2i} \Delta LEG_{t-i} + \theta_1 LRG_{t-1} + \theta_2 LEG_{t-1} + u_t \quad (3)$$

$$\Delta LRG_t = \alpha_0 + \sum_{i=1}^n \beta_{1i} \Delta LRG_{t-i} + \sum_{i=0}^n \beta_{2i} \Delta LEG_{t-i} + \gamma E_{t-1} + u_t \quad (4)$$

Where, α_0 is the intercept and u_t is error term. F test is used whether a cointegration among the variables exist or not. Null hypothesis of no co-integration in the above equation is as

$H_0: \theta_1 = \theta_2 = 0$, against the alternative hypothesis $H_1: \theta_1 = \theta_2 \neq 0$.

For investigating the presence of long run relationship among variables the bound testing procedure is used in which the null hypothesis (H_0) of no co-integration is tested against alternative hypothesis (H_1) of the existence of co-integration. This ARDL bound test is based on Wald test (F-statistic), in which two critical values are given by Pesaran et al. [20]. If the computed F-statistic is higher than the upper bound critical value, the null hypothesis of no co-integration is rejected. On the other hand the null hypothesis of no co-integration is not rejected, if the F-statistic is less than the lower bound critical value. If the computed F-statistic falls between the two critical bound values, then the results for co-integration are inconclusive.

If the long run relationship is confirmed in the above test, then the following error correction model (ECM) is used to estimate the short run coefficients.

$$\Delta LRG_t = \alpha_0 + \sum_{i=1}^n \beta_{1i} \Delta LRG_{t-i} + \sum_{i=0}^n \beta_{2i} \Delta LEG_{t-i} + \gamma EC_{t-1} + u_t \quad (5)$$

Where, γ speed of adjustment and EC is the error correction term (Table 1).

Table 1: Descriptive Statistics.

	LRG	LEG
Mean	-0.727	-0.579
Median	-0.728	-0.571
Maximum	-0.65	-0.533
Minimum	-0.691	-0.616
Std.Dev.	0.036	0.021
Skewness	0.284	-0.299
Kurtosis	2.392	2.496
Jarque-Bera	0.779	0.689

THRESHOLD CO-INTEGRATION APPROACH

GH and HJ have taken level shift (C), level shift with trend (C/T)' and regime shift (C/S) models to test the structural breaks in co-integration tests. Our study takes regime shift model for both GH and HJ co-integration tests. GH test has taken one break point whereas HJ has incorporated two break points. The regime shift model illustration of eqn. (2) for GH and HJ tests which incorporate structural breaks on both intercept and slope are defined as:

GH test:

$$LRG_t = \beta_0 + \beta_1 D_{1t} + \alpha_1 LEG_t + \alpha_2 D_{1t} LEG_t + u_t \quad (6)$$

HJ Test:

$$LRG_t = \beta_0 + \beta_1 D_{1t} + \beta_2 D_{2t} + \alpha_1 LEG_t + \alpha_2 D_{1t} LEG_t + \alpha_3 D_{2t} LEG_t + u_t \quad (7)$$

Where β_0 is common intercept and β_1 is the differential intercept over the common intercept in eqn. (6), but differential intercept over the common intercept for the first sub sample of structural break in eqn. (7). The differential intercept β_2 over the common intercept β_0 is second structural break in eqn. (7).

D_{1t} is dummy variable for the endogenous structural break at time $t=1,2,\dots,n$ for eqn. (6), but for eqn. (7), dummy variable to represent the first endogenous break; D_{2t} is

the dummy variable representing the second endogenous structural break at time $t=1,2,\dots,n$ for eqn. (7).

$$D_{1t}=0; \text{ if } t < [nT_1]$$

$$=1; \text{ if } t > [nT_1]$$

$$D_{2t}=0; \text{ if } t < [nT_2]$$

$$=1; \text{ if } t > [nT_2]$$

The dummy variables with the known parameters T_1 and T_2 belonging to the 0, 1 meaning the relative timing of regime change point or structural break points which are not known a priori. The standard methods for testing the null hypothesis of no co-integration for eqns. (6) and (7), when there are no dummies for structural breaks are residual based approach of Engle et al. [18]. GH has shown that residual based tests namely Augmented Dickey-Fuller (ADF) and, Z_t test proposed by Perron [23] applied to regression errors to test the null hypothesis of no co-integration leads to misspecification of co-integration if the structural breaks are unknown. GH has however used an advanced nonlinear co-integration test with a structural break which is considered as multivariate extension of univariate ZA (Zivot Andrew) unit root test [24]. Gregory et al. [21] proposed a residual based co-integration test (GH-test) that takes into account regime shifts either in the intercept or the entire vector of coefficients. They proposed biased –corrected modified ADF*, $Z\alpha^*$ and Zt^* for testing co-integration of the above variables.

$$ADF^* = \inf ADF(\tau) \quad (8)$$

$$(\tau) \in T$$

$$Z_t^* = \inf Z_t(\tau) \quad (9)$$

$$(\tau) \in T$$

$$Z_a^* = \inf Z_a(\tau) \quad (10)$$

$$(\tau) \in T$$

The null hypothesis of no co-integration is tested first by running regression of eqns.

(6) and (7) for each possible structural break $\tau \in T=(0.15, 0.85)$ in the case of GH test and $\tau_1 \in T_1=(0.15, 0.70)$ and $\tau_2 \in T_2 (0.15, 0.85)$ for HJ test. Then applying eqns. (8)-(10) for regression errors of each possible structural breaks. The smallest value of (8)-(10) is chosen to compare against the critical values of one –break point and two-break point test developed by GH and HJ respectively, to accept and reject the null hypothesis of no co-integration.

Table 2: Zivot-Andrew Unit root test.

	Model A (intercept)		Model B (trend)		Model C (intercept and trend)	
	t-Stat	Break Year	t-Stat	Break Year	t-Stat	Break Year
LRG	-3.136	1996-97	-3.673	1998-99	-3.771	2002-03
LEG	-4.962	2010-11	-4.592	2004-05	-4.791	2010-11

DATA ANALYSES AND RESULTS

First of all before making the co integration test, we check the stationary of the variables or integrity of the variables .The study used ADF, PP, and KPSS test of unit root for both intercept and trend taking together. The unit root result are presented in Table 2, The variables are stationary at level in case of KPSS test but in case of PP test LRG and LEG both are stationary at first difference at 1% level of significance. ADF test shows that LRG is stationary at first difference at 1% level of significance but LEG is stationary at level at 5% level of significance. The result of Zivot-Andrews test has also been shown (Table 2). In Zivot-Andrews test two breaks found 2002-03 and 2010-11 in model C. Model C shows both intercept and tend in the series. Unit root table reveals that there is a mixtures of the order of integration for the variables consequently for co-integration relationship, we have used ARDL model (Table 3).

Table 3: Stationary test result.

Variables	ADF Test		PP Test		KPSS Test	
	Level	First difference	Level	First difference	Level	First difference
LRG	-2.422	-6.471***	-2.249	-6.724***	0.133***	0.159***
LEG	-3.602**	-3.342*	-2.682	-4.507***	0.681***	0.091***
Note: ***, **, * denote statistical significant at 1%, 5%, and 10% level respectively						

Now after testing stationary we proceed for ARDL bound test (Table 4) for checking the long-run relationship between the variables. The test reveals that the calculated F statistic is 2.553 which falls below the lower bound I (0) at 10% level of significance [20].

Table 4: ARDL co-integration bound testing approach result.

ARDL Function	Optimal Lag Length	F Statistics
LRG LEG	(1,0)	(2.553)
Significance Level	Critical Bound F- Values	
	Lower	Upper
1%	4.94	5.58
5%	3.62	4.16
10%	3.02	3.51
Diagnostics Test		
R-squared	0.671	
Adjusted R-squared	0.651	
F statistic (prob.value)	24.373(0.000)	
Breusch-Godfrey LM test	0.611	
Jarque-Bera	0.971	
White's hetroscedasticity test	0.307	

The results of threshold co-integration tests are given in Table 5 which reveals that in

case of GH modified ADF^* , z_t^* , and z_α^* test under the regime shift model fails to reject the null hypothesis of no co-integration relationship at 1% level of significance. For two structural breaks we applied HJ test found that ADF^* test rejected the null hypotheses of no co-integration at 1% level of significance. Here co-integration relation is found for two structural breaks under regime shift model at 1% level of significance. The identified breaks years are, 1994-95, 2002-03 in two break models. The breaks are as a response of policy changes. FRBM (Fiscal Reform and Budget Management Act) was introduced in 2003.

Table 5: Threshold co-integration test with Regime Shift.

	ADF^*	z_t^*	z_α^*
GH Test	-3.634 (2004-05)	-3.706 (2004-05)	-20.025 (2004-05)
HJ Test	-61.503*** (0.185,0.481)	-5.178 (0.333,0.444)	-28.565 (0.222,0.370)
Note: *** Significant at 1% level of significance. The number in parentheses represents break points. The critical values for GH and HJ tests are available in GH (1996, pp109) and HJ (2008, pp501).			

Table 6: Estimated parameter values with two endogenous breaks.

	Base	First Sub-Sample (D1)	Second Sub-Sample (D2)	
Intercept	β_0	β_1	β_2	Total
	-0.469 (-0.886)	-0.313 (-0.538)	0.297 (-0.953)	-0.485
LEG	α_1	α_2	α_3	
	0.474 (0.510)	-0.503 (-0.495)	0.418 (0.773)	0.389
Diagnostics Test				
R-squared	0.642			
Adjusted R-squared	0.556			
F statistic (prob.value)	7.543 (0.0)			
Breusch-Godfrey LM	0.107			
Jarque-Bera	0.175			
White's heteroscedasticity	0.357			
Note: Figures in brackets are t-statistics.				

After confirming the presence of co-integration in two structural break model (HJ), next step is to find out the coefficient of long-run relationship and draw the result of the degree of debt sustainability. We have calculated the coefficient of parameters for two endogenous breaks model .The result reveals in the Table 6 that the coefficient is 0.389 in double structural break model which is less than one. So here values are supporting only for weak sustainability rather than strong public debt sustainability.

Figure 3: Plot of parameter stability.

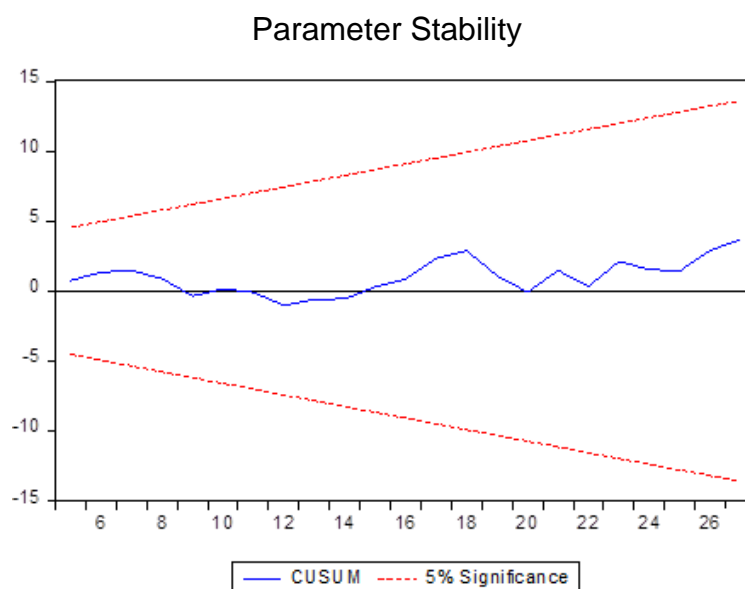
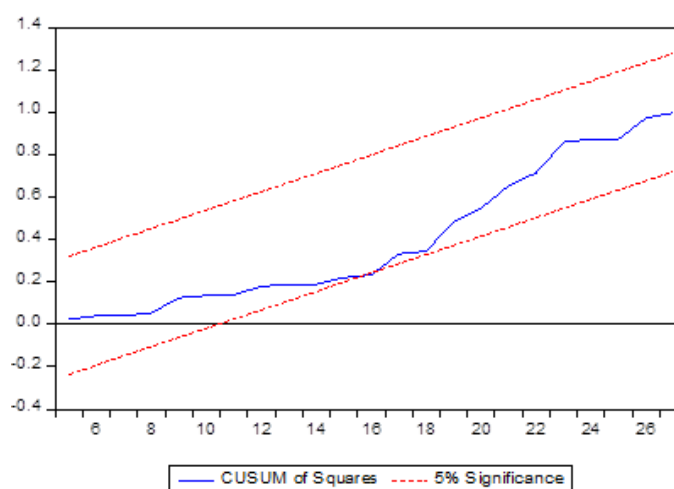


Figure 4: Plot of parameter stability.



The result of CUSUM and cumulative sum of squares of recursive residuals (CUSUMQ) tests which are given in the parameter stability graph. The results reveal that our model is stable at the given level of significance (5%) (Figures 3 and 4).

CONCLUSION AND POLICY IMPLICATIONS

High public debt is the major problem of all the developing nations, like India at present. Increasing debt/GDP ratio curtails private investment as government pay this debt through borrowing from the market which leads to high interest rate. Hence sustainability of debt is needed for the smooth working of the economy.

The present study has examined the public debt sustainability of public debt in case of India for a period of 1991 to 2016. We investigated a nexus between government revenues and expenditures for testing the sustainability of debt. The ARDL bound testing approach used to test check the variables for co-integration. Furthermore Gregory-Hansen and Hatemi-j threshold co-integration test are applied to check the co-integration relationship in the presence of unknown endogenous structural breaks.

The ARDL model did not confirm any long-run relationship between the variables government revenues and expenditures. In case of threshold co-integration test only HJ test provide the result in support of co-integration relation. The endogenous structural break is found in, 1994-95, and 2002-03. However the estimated parameter or slope parameter not supporting the debt sustainability. The coefficients are insignificant in HJ (two endogenous breaks) test as the values of coefficient are less than one calculated Table 6.

The country, India can get free from the burden of high debt and deficit if available recourses are used properly. Situations are dete from Bal and Rath [25], rioting by misuse of recourses as recourses have never been taken properly. Fiscal deficit in budget is due to high non developmental expenditures of the government, deficit can

be controlled by reducing such expenditures.

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REFERENCES

1. Handbook of Statistics on Indian Economy (2012) Reserve Bank of India.
2. Domar ED (1944) The "burden of the debt" and the national income. *The American Economic Review* pp: 798-827.
3. Hakkio CS, Rush M (1991) Is the budget deficit "too large?". *Economic inquiry* 29: 429-445.
4. Quintos CE (1995) Sustainability of the deficit process with structural shifts. *Journal of Business and Economic Statistics* 13: 409-417.
5. Buiter WH, Patel UR (1992) Debt, deficits, and inflation: an application to the public finances of India. *Journal of Public Economics* 47: 171-205.
6. Oshikoya TW, Tarawalie AB (2010) Sustainability of fiscal policy: the West African monetary zone (WAMZ) experience. *Journal of Monetary and Economic Integration* 9: 1-29.
7. Lusinyan L, Thornton J (2009) The sustainability of South African fiscal policy: an historical perspective. *Applied Economics* 41: 859-868.
8. Jha R, Sharma A (2004) Structural Breaks, Unit Roots, and Cointegration: A further test of the sustainability of the Indian fiscal deficit. *Public Finance Review* 32: 196-219.
9. Deyshappriya NR (2012) Debt and fiscal sustainability in Sri Lanka. *International Journal of Scientific and Research Publications* 2: 1-8.

10. Goyal R, Khundrakpam JK, Ray P (2004) Is India's public finance unsustainable? Or, are the claims exaggerated? *Journal of Policy Modeling* 26: 401-420.
11. Abdullah H, Mustafa MM, Dahalan J (2012) An empirical study on fiscal sustainability in Malaysia. *International Journal of Academic Research in Business and Social Sciences* 2: 72.
12. Afonso A, Rault C (2007) Should we care for structural breaks when assessing fiscal sustainability? *Economics Bulletin* 3: 1-9.
13. Mahmood H, Habib A, Rehaman JU, Zafar T (2014) Does Sustainability Hypothesis Hold In Developed Countries? A Panel Co-Integration Analysis. *International Journal of Global Business* 7: 57.
14. Kuştepelı Y, Onel G (2005) Fiscal deficit sustainability with a structural break: An application to Turkey. *Review of Social, Economic and Business Studies* 5: 1-20.
15. Tanner E, Liu P (1994) Is the budget deficit "too large"?: Some further evidence. *Economic Inquiry* 32: 511-518.
16. Trehan B, Walsh CE (1988) Common trends, the government's budget constraint, and revenue smoothing. *Journal of Economic Dynamics and Control* 12: 425-444.
17. Kalyoncu H (2005) Fiscal policy sustainability: test of intertemporal borrowing constraints. *Applied Economics Letters* 12: 957-962.
18. Engle RF, Granger CW (1987) Co-integration and error correction: representation, estimation, and testing. *Econometrica: Journal of the Econometric Society* pp: 251-276.
19. Johansen S, Juselius K (1990) Maximum likelihood estimation and inference on cointegration-with applications to the demand for money. *Oxford Bulletin of Economics and statistics* 52: 169-210.
20. Pesaran MH, Shin Y, Smith RJ (2001) Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics* 16: 289-326.
21. Gregory AW, Hansen BE (1996) Residual-based tests for cointegration in models with regime shifts. *Journal of Econometrics* 70: 99-126.

22. Hatemi-J A (2008) Tests for cointegration with two unknown regime shifts with an application to financial market integration. *Empirical Economics* 35: 497-505.
23. Perron P (1989) The great crash, the oil price shock, and the unit root hypothesis. *Econometrica: Journal of the Econometric Society* pp: 1361-1401.
24. Zivot E Andrew D (1992) Further evidence on great crash, the oil price stock, and the unit root hypothesis. *Journal of Business and Economic Statistics* 10: 251-270.
25. Bal DP, Rath BN (2014) Public debt and economic growth in India: A reassessment. *Economic Analysis and Policy* 44: 292-300.