The Dynamics of Fiscal Deficit and Economic Growth: A Threshold Analysis for the State of Odisha in India

Ashok Kumar Sar[1] and Satya Priya Rath[2]

[1]*Kalinga Institute of Industrial Technology (KIIT University), Bhubaneswar, India. Email: aksar@ksom.ac.in*
[2]*Research Scholar, School of Management, KIIT University, Bhubaneswar, India. Email: satyaratha@gmail.com*

ABSTRACT

The aim of the study is to estimate a threshold level of fiscal deficit, which would align with sustainable higher rate of economic growth, and financial sustainability. Publicly available financial data from economic surveys and annual budget documents for the period 1950-51 to 2014-15 are used for the study. Econometric tools/ methods like Augmented Dicky-Fuller unit root test, Phillips-Perron unit root test, Johansen and Juselius co-integration techniques, and Vector Error Correction are used to analyze data. The threshold level of fiscal deficit is estimated to be 3.5%. Beyond 3.5% of fiscal deficit, the economic growth is expected to slow down.

JEL Classification Codes: E620, O4, C3.

Keywords: Fiscal deficit, Economic growth, Financial sustainability, Public policy.

1. INTRODUCTION

Macroeconomic stability is critical to achieve higher level of sustained growth. It has mainly three dimensions, (a) price stability, (b) fiscal consolidation and (c) current account deficit. However, concerns on fiscal deficit are equally significant for sustaining higher level of economic growth. During a situation, when an economy is operating below its potential, public spending comes under much pressure. More specifically, when private investment is less, the policy makers prescribe the standard policy prescription to raise public spending in general and public investment in particular. In a country like India, the role of public sector is still important in critical sectors like railways, roads, power and coal. But, now the question arises whether there should be a deviation from the road map for fiscal consolidation under these circumstances. The fiscal road map as indicated by the 2015 Union Budget was a target fiscal deficit of 3.5% for 2016-17 and 3% for 2017-18. At this particular juncture, we need to have an appropriate perspective on fiscal deficit. Consistent

and persistent rise in fiscal deficit may lead to rise in the debt-GDP ratio. High share of revenues will be needed to service debt due to high debt-GDP ratio, leaving less revenues for productive developmental expenditures. After much debate and discussion, the Fiscal Responsibility and Budget Management (FRBM) Act was passed in 2003 in India. Three per cent of GDP was fixed for the central government under this Act. The state governments also moved forward to fix a target for fiscal deficit after the recommendation of the 12th Finance Commission.

Different school of thoughts namely, Keynesian, Neoclassical and Ricardian differ in their view concerning the issue of an economy's fiscal deficit. While Keynesian economists strongly advocate about the positive impact of fiscal deficit on economic growth, the neo classical economists oppose it. Further, Ricardian economists believe in neutral relationship between fiscal deficit and economic growth (Bernheim, 1989).

First, Keynesian economists reveal that raising public expenditure or in different term, raising fiscal deficit will drive aggregate demand and improve the confidence of the investors on the economic potential. This will boost investments and aggregate savings, which, in turn, results in sustained high economic growth. However, Keynesian school of thought was empirically questioned when it could not address the problems during the world economic recession in 1970s and the boom in 1980s.

Second, the supporters of neoclassical economists believe that the current fiscal deficit will transfer high tax burden to the future which encourages consumers to increase consumption at present and thus depresses the domestic savings. Also, if the domestic borrowings will be used to finance the fiscal deficit then the amount of loanable funds to private sectors will decline, rate of interest rises and private investments are discouraged (Saleh, 2003). In both the above cases, increase in fiscal deficit will crowd out private investments and acts as a constraint in the efficient allocation of resources. In an economy under the full employment of resources in the goods market, any increment of public expenditure must inevitably lead to a decline in the equal amount of the private expenditure and adversely affects the real economic activity (Buiter, 1977).

Third, Barro (1989) the profounder of the Ricardian equivalence hypothesis argues that fiscal deficit will have neutral effect on economic growth. As fiscal deficit increases with the increase in the public expenditure, people think that anticipate the tax rise in the future and accordingly plan to reduce consumption and to save more. Meanwhile, deficits tend to decrease public savings while in the other, private savings increases and keep gross domestic savings remain unchanged (Saleh, 2003).

However, too much of public spending may adversely affect economic growth. Hence, in the arena of fiscal deficit literature, the researchers attempted to estimate the threshold level of fiscal deficit. Further, a statement put forth by the Union Finance Minister, Mr. Arun Jaitly while presenting the budget speech 2016-17- "***There is a suggestion that fiscal expansion or contraction should be aligned with credit contraction or expansion respectively in the econom**y*", indicated a paradigm shift in estimation of fiscal deficit. The Fiscal Deficit target for Odisha as suggested by FRBM Act is 3%. To preface the reality check on the FRBM law, it is necessary to know how the 3% fiscal deficit limit emerged. The story is amusing, even bizarre. The magic number made its debut in the famous Maastricht Treaty to form the European Union (EU) in 1992. The treaty prescribed four criteria which EU members had to comply to be eligible to adopt the Euro as the common currency, (a) 3% fiscal deficit limit, (b) limits on inflation, (c) limits on long-term interest rates and (d) limits on public debt (Gurumurthy, 2016). Now, question arises how 3%

limit got its celebrated status in Indian fiscal economics. It was an open secret that the FRBM Act enacted in 2003 and implemented from 2004, had adopted the ready-made EU limit of 3%. Some experts criticized the fiscal limit of 3 per cent and revealed that the EU rate of 3% was carbon copied into the FRBM Act in India and treated it as a magic number without any logic. Since, no empirical study has been found in leading scholarly journals on threshold fiscal deficit for Odisha, the present study aims to estimate the threshold fiscal deficit limit.

As presented in Figure 1, that fiscal deficit ratio (FDR) has been within the range of 0-3% with the average gross state domestic product (GSDP) growth rate at 12.54%. As the FDR increases from the range of 0-3% to 3-6% and further to above 6%, the average GSDP growth rate declines from 12.54% to 10.57% and further to 7.88 per cent respectively. During the fiscal surplus period, the average GSDP growth rate is the highest. This preliminary evidence attracts the researchers to calculate the threshold fiscal deficit for Odisha. Globally, there have been a few researches on fiscal deficit threshold (Akosah, 2013; Weng, Meu, Hoong, Ean, & Shun, 2011). However, for Odisha, there is no prior study to gain insights into the threshold fiscal deficit. Hence, estimation of fiscal deficit threshold for Odisha will add value to the existing fiscal deficit literature.
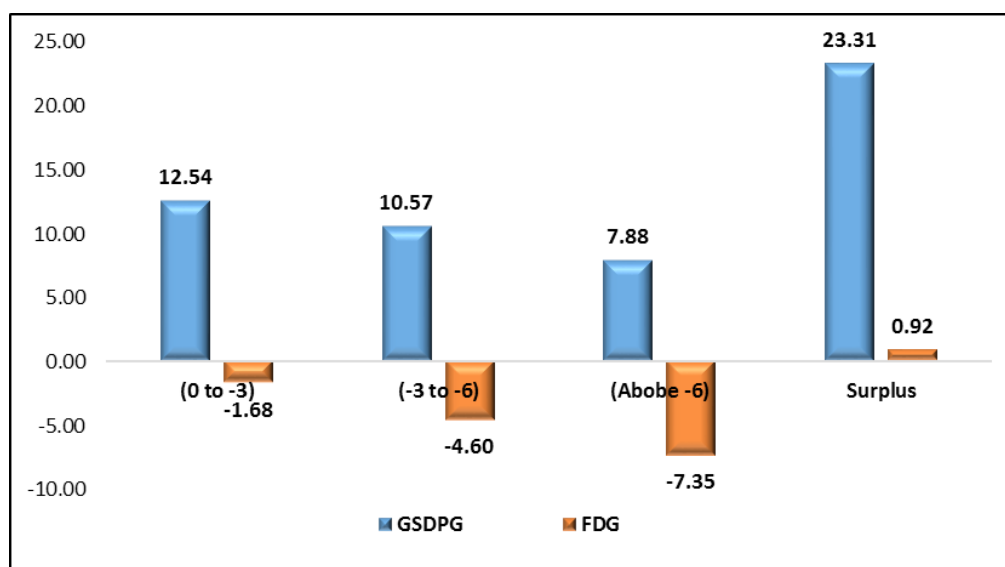

Figure 1: Growth Rates of Gross State Domestic Product and Fiscal Deficit Ratio

2. DATA AND METHODOLOGY

Data for the study has been taken from the Finance Account, Government of Odisha. Nominal GSDP growth rate and fiscal deficit ratio has been calculated for the estimation of threshold deficit level.

Augmented Dicky-Fuller unit root test (ADF) is used to assess the stationarity conditions of the variables. It is necessary to first analyze the stationarity of the data series for checking the suitability of the data to apply the co-integration technique. Phillips-Perron unit root test is used to check the robustness of the unit root test. Johansen and Juselius (JJ) co-integration techniques is used to find out whether there exists any co-integrating vector to establish long-run relationship between the variables. Vector Error Correction Mechanism (VECM) is used to estimate the speed of adjustment of the variables in long-run.

2.1. Threshold Model

The threshold model used to determine the threshold level for fiscal deficit is based on the work of Khan and Senhadji (2000) that was originally used for analysis of threshold level for inflation. Threshold level of fiscal deficit is based on the following equation:

$$\text{LNGSDP}_t = \beta_0 + \beta_1(\text{FDR}_t) + \beta_2 \times D_t(\text{FDR}_t - k) + U_t \qquad (1)$$

LNGSDP: Natural Logarithm of Gross State Domestic Product at current prices. FDR: Fiscal Deficit Ratio as percentage of GSDP. Besides, β_0 is the intercept constant, β_1 and β_2 are the coefficients, D_t is the time dummy taken for the FDR and U_t is the error term. While the value of k is given arbitrarily for the estimation, the optimal k is obtained by finding that value that minimizes the residual sum of squares (RSS). Thus, the optimal threshold level is that which minimizes the sequence of residual sum of square (RSS). Fiscal deficit at this level has a significant impact on economic growth.

3. ANALYSIS AND RESULTS

The empirical analysis of the present study began with assessing the stationarity conditions of the variables used in our study by applying augmented Dicky-Fuller (ADF) and Phillips-Perron (PP) unit root test. The results of the unit root test are reported in the Table 1. The unit root test results conclude that both the variables such as FDR and LNGSDP are stationary at first order difference.

Table 1
Results of Unit Root test

Variables	*ADF test*		*Phillips – Perron test*		*Inference*
	Level	*First Diff.*	*Level*	*First Diff.*	
FDR	–3.03 (0.13)	–10.46 (0.00)	–2.12 (0.52)	–8.72 (0.00)	I(1)
LNGSDP	–2.20 (0.47)	–8.75 (0.00)	–2.99 (0.14)	–10.46 (0.00)	I(1)

Note: Figure in Parentheses are P-Values.

Once the stationarity of the variables is determined, this study used the Johansen and Juselius (2009) co-integration technique to trace the existence of long-run relationship between them. The results are presented in Table 2. Before conducting the Johansen and Juselius test, this study choose the optimal lag 1 through VAR model by following AIC, SC and HQ criteria. It is observed from the Table 2 that there is at most 1 co-integrating vector that exist between fiscal deficit and economic growth.

Table 2
Results of Johansen and Juselius Co-integration Test
Dependent Variable LNGSDP

Null Hyp.	*Alternative Hyp.*		*95% Critical Value*
λ_{trace} test		λ_{trace} value	
$r = 0$	$r > 0$	50.34	20.26
$r \leq 1$	$r > 1$	6.25	9.16
λ_{max} test		λ_{max} value	
$r = 0$	$r = 1$	44.08	15.89
$r = 1$	$r = 2$	6.25	9.16

Note: Figure in Parentheses is P-Value and *** indicates significant at 1 percent Level.

From Table 2, it is concluded that the null hypothesis of no co-integration is rejected but the null of at most 1 co-integration relationship between the variables cannot be rejected because both the trace test as well as max-Eigen test confirm 1 co-integrating relation between two variables. This implies the existence of long-run association between fiscal deficit and economic growth in Odisha.

Further, in order to trace the speed of adjustment in terms of the relation between fiscal deficit and economic growth, this study used vector auto regressive model (VECM). The error correction term of the one period lag (ECM_{t-1}) shows the speed of adjustment between fiscal deficit and economic growth in Odisha. The result is presented in the Table 3. The ECM_{t-1} term is negative and significant when the GSDP is the dependent variable whereas it is not significant when the fiscal deficit is the independent variable. Hence, it is concluded fiscal deficit in the long run causes economic growth but not the other way. This implies that both the variables i.e. fiscal deficit and economic growth are adjusting around 16 percent every year.

Table 3
Vector error correction mechanism (VECM)

Error Correction:	D(LNGSDP)	D(LFD)
D(LNGSDP(-1))	–0.12 (–0.98)	–0.23 (–0.09)
D(LFD(-1))	–0.02** (–2.13)	–0.23 (–1.68)
C	0.12* (7.80)	0.04 (0.11)
e_{t-1}	–0.16* (–4.33)	–0.24 (–0.33)

Notes: * and ** denote significance at 1 per cent and 10 per cent level. *t*-values are given in the parentheses.

After examining the long run causality between fiscal deficit and economic growth, we moved further to assess the direction of short run causality between fiscal deficit and economic growth using VEC Granger causality/block-exogeneity Wald test. The VEC granger causality test again confirmed the unidirectional causality that runs from fiscal deficit to economic growth. The estimated block-exogeneity Wald test results are reported in Table 4.

Table 4
VEC Granger causality/block-exogeneity Wald tests

Null Hypothesis	X^2	P-Value	Inference
D(FDR) does not Granger Cause LNGSDP	4.52**	0.03	D(FDR) $\rightarrow$ D(LNGSDP)
D(LNGSDP) does not Granger Cause D(FDR)	0.01	0.92	

Note: FDR = Fiscal Deficit Ratio; LNGSDP = Natural Logarithm of Gross State Domestic Product; * and ** indicates the significant at 10 and 5 percent level respectively.

In the earlier empirical section, it was found that fiscal deficit causes economic growth both in the short run and long run but there is no feedback from economic growth to fiscal deficit. This result helps in the choice of dependent and independent variable for the threshold model specification.

The P-values on $\widehat{\beta}_1$ suggest that for low fiscal deficit levels ($k \le 2$), there is an insignificant relationship between fiscal deficit and economic growth (see Table 5). For higher deficit level ($k > 2.5$) there is a significant positive relationship between output growth and fiscal deficit. The insignificant relationship is translating into significant one as the level of fiscal deficit (k) increases above 2.5 percent. Finally, 3.5

percent fiscal deficit level is a threshold level, which is obtained by finding that value of k that minimizes the (RSS) residual sum of squares (see Figure 2). If fiscal deficit increases above threshold level, growth is estimated to decline. Beyond that level, there might be a significant shock to economic performance of the country.

Table 5
Estimation of Non-Linear Model at k = 2 to 4.5

| K	Variable	Coeff.	t-stat.	Prob.	RSS	R-Square
2%	FDR	1.203	1.425	0.159	259.31	0.064
	(FDR>2)*(FDR-2)	0.986	1.161	0.250		
	C	10.619	10.944	0.000		
2.5%	FDR	1.788	3.816	0.000	222.41	0.197
	(FDR>2.5)*(FDR-2.5)	1.483	3.444	0.001		
	C	11.707	15.061	0.000		
3%	FDR	−1.802	−4.455	0.000	209.13	0.245
	(FDR>3)*(FDR-3)	1.4706	4.068	0.000		
	C	11.908	16.159	0.000		
3.5%	FDR	−1.684	−5.328	0.000	190.07	0.314
	(FDR>3.5)*(FDR-3.5)	1.349	4.942	0.000		
	C	11.956	18.155	0.000		
4%	FDR	−0.665	−2.952	0.004	242.95	0.123
	(FDR>4)*(FDR-4)	0.447	2.369	0.020		
	C	10.547	16.346	0.000		
4.5%	FDR	−0.654	−3.008	0.004	241.77	0.127
	(FDR>4.5)*(FDR-4.5)	0.445	2.438	0.018		
	C	10.568	16.427	0.000		
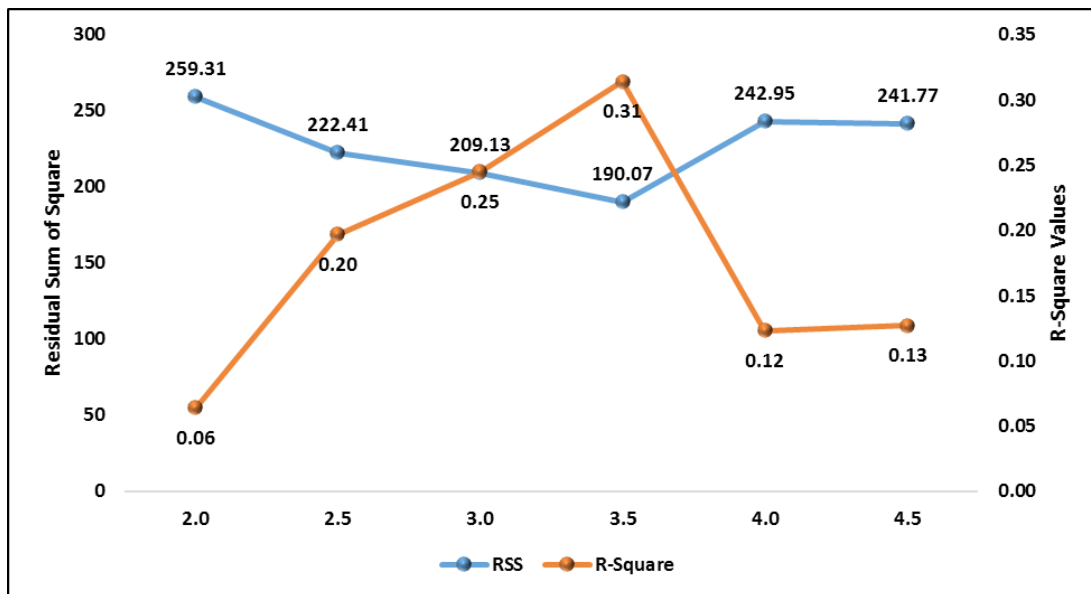
Figure 2: Plots of Residual Sum of Square and R-Square Values

The estimation of Equation (1) gives a precise value of threshold fiscal deficit level and also quantifies the impact of that level on economic growth (Table 5). For this purpose Equation (1) is estimated and the residual sum of square (RSS) for threshold level of fiscal deficit ranging from k_1 percent to k_n percent was computed. The optimal threshold level is the one that minimizes the sequence of RSS (Table 5). The t-statistics and their p-vales of following estimated equation are given in Table 5.

4. CONCLUSION

The preliminary evidence suggested that the higher fiscal deficit is associated with low economic growth rate while fiscal surplus reflects high economic growth. However, the causality results under VECM framework suggested the unidirectional causality that runs from fiscal deficit to economic growth rate in Odisha for the period 195-051 to 2014-15. Hence, we move forward and select the GSDP growth as dependent variable and FDR as independent variable to calculate the fiscal deficit threshold for Odisha. The threshold model identifies 3.5 per cent as the fiscal threshold value up to which the government of Odisha could go. Above that limit, the fiscal deficit has significant and adverse effect on economic growth rate. Hence, the empirical analysis suggests that the government of Odisha can go ahead up to 3.5 per cent of fiscal deficit instead of 3 per cent set by the FRBM Act limit which can trigger high and sustained economic growth rate.

References

Akosah, N. K. (2013). Threshold Effect of Budget Deficits on Economic Growth in Ghana: An Empirical Analysis, *1*(1), 1–24. http://doi.org/10.13189/aeb.2013.010207.

Barro, R. (1989). Ricardian Approach to Budget Deficits. *Rnal of Economic Perspectives*, *3*(2), 37–54.

Bernheim, B. D. (1989). A Neoclassical Perspective on Budget Deficits. *Journal of Economic Perspectives*, *3*(2), 55–72. Retrieved from http://www.aeaweb.org/articles?id=10.1257/jep.3.2.55.

Buiter, W. H. (1977). Crowding out? and the effectiveness of fiscal policy. *Journal of Public Economics*, *7*(3), 309–328. http://doi.org/10.1016/0047-2727(77)90052-4.

Gurumurthy, S. (2016). Fiscal Deficit:Story of the Magic "3" Per cent. Retrieved June 16, 2017, from http://www.newindianexpress.com/opinions/columns/s-gurumurthy/2016/feb/25/Fiscal-DeficitStory-of-the-Magic-3-Per-cent-896698.html.

Johansen, S., & Juselius, K. (2009). MAXIMUM LIKELIHOOD ESTIMATION AND INFERENCE ON COINTEGRATION - WITH APPLICATIONS TO THE DEMAND FOR MONEY. *Oxford Bulletin of Economics and Statistics*, *52*(2), 169–210. http://doi.org/10.1111/j.1468-0084.1990.mp52002003.x.

Khan, M., & Senhadji, A. (2000). *Khan 2000.pdf* (No. WP/00/110).

Saleh, A. (2003). *The Budget Deficit and Economic Performance: A Survey* (No. Working Paper 03-12). Retrieved from http://ro.uow.edu.au/commwkpapers/78.

Weng, C., Meu, E., Hoong, L., Ean, T., & Shun, T. (2011). *Debt, budget deficit and economic growth of Malaysia.* TUNKU ABDUL RAHMAN.