Working Paper No. 78

Dynamic Causal Relationship between Government Expenditure and Revenue in Odisha: A Trivariate Analysis

Shibalal Meher

Nabakrushna Choudhury Centre for Development Studies, Bhubaneswar
(an ICSSR institute in collaboration with Government of Odisha)

May 2020

Dynamic Causal Relationship between Government Expenditure and Revenue in Odisha: A Trivariate Analysis

Shibalal Meher[1]

Abstract

The purpose of the study is to investigate the causal relationship between government revenue and expenditure in Odisha by applying ARDL bounds testing approach to cointegration and error correction model over the period 1981-82 to 2016-17. NSDP is added for a trivariate investigation to obviate variable omission bias. The results show that there is unidirectional causal relationship between government expenditure and revenue with the direction of causality running from revenue to spending in the long run. This result is consistent with the tax and spend hypothesis.Under this hypothesis, the most effective way of correcting fiscal imbalance is to increase revenue and cut spending. Hence, the fiscal authorities of Odisha should increase revenue and decrease expenditure to correct fiscal imbalance in the state.

Key words: Government Revenue, Government Expenditure, ARDL bounds testing, Granger Causality, Odisha

JEL Codes: C22, E62, H70

Acknowledgements: This is a revised version of the paper presented in the 56th Annual Conference of The Indian Econometric Society (TIES), held at Madurai Kamaraj University, Madurai from 8th to 10th January 2020. I am thankful to the participants for their useful comments. The views expressed in the paper are that of the author and not the institution he belongs.

[1]Professor of Development Studies, Nabakrushna Choudhury Centre for Development Studies, Bhubaneswar. E-mail: shibalal.ncds@gov.in; smeher62@rediffmail.com

Contents

1. Introduction

Attempts at fiscal consolidation often face the dilemma of whether to reduce the expenditure, or increase the revenue. It is therefore necessary to understand the causal relationship between expenditure and revenue of government as this can contribute to a better understanding on the causes and consequences of large fiscal deficit. Odisha, one of the poorest states in India, had revenue surplus prior to the 1980s. However, the condition of major fiscal indicators worsened from early 1980s till 2004-05 (Figure 1), implying the growing resource gap during the period. Thereafter revenue surplus prevailed, which however fluctuated. On the other hand, the fiscal deficit prevailed in almost in all years (except four years). The deficit indicators showed improvement from 2004-05, but again deteriorated after the global crisis on 2007-08. The Odisha government enacted Fiscal Responsibility and Budget Management (FRBM) Act in 2005, wherein fiscal targets were earmarked with provisions to boost revenue and cut-down unproductive expenditure. Even though Odisha achieved the fiscal target earmarked in the FRBM Act, still the fiscal deficit has started increasing rapidly in the recent years. In 2019-20, as per revised figures, it is estimated to 3.41 per cent of GSDP. The debt liability has also been increasing rapidly and has estimated to be Rs. 103842.86 crore in the 2019-20, which is 19.20 per cent of GSDP. In order to correct the fiscal deficit, the knowledge on the nexus between government revenue and expenditure is important. This has generated renewed interest to study the relationship between revenue and expenditure of the state government.

There are several studies dealing with the relationship between government revenue and expenditure. But these studies do not provide conclusive results regarding the relationship as these are time and country specific, and use different methodology. Hence, there is no specific prescription of fiscal consolidation for all situations. Odisha state lacks rigorous studies on the relationship between the two. The inconclusive results of earlier studies and lack of studies in the state of Odisha, provide an impetus to examine the nexus between government revenue and expenditure in Odisha. Further, most of the existing studies use bivariate method, and hence suffer from variable omission bias. The present study attempts to overcome this by using trivariate model to examine the causal relationship between government revenue and expenditure.

The remainder of this study is organised as follows. The second section provides a review of literature. The third section presents the data and methods used in the study. The fourth section discusses the findings. The last section brings the concluding observations and policy implications.

2. Review of Literature

The relationship between government expenditure and revenue is usually explained by four major conflicting hypotheses, viz., tax-and-spend hypothesis, spend-and-tax hypothesis, fiscal synchronization hypothesis, and institutional separation or neutrality hypothesis.

The tax-and-spend hypothesis, known as 'revenue dominance hypothesis', indicates the existence of causality between revenue and spending, with the direction of causality running from revenue to spending (Hasan and Lincoln, 1997). Two important schools of thought, viz. Chicago School and Virginia School of Political Economy, argue in support of this hypothesis. Friedman (1978), the proponents of Chicago school, argues that when government revenue increases, the government spending is expected to increase. Therefore, to solve the budget deficit problem, he recommends for lowering taxes. Buchanan and Wagner (1977), proponents of Virginia School of Political Economy, on the other hand, believe that the relation is negative rather than positive as Friedman suggests. According to them the most effective way of correcting fiscal imbalance is to increase tax revenue and cut spending. This hypothesis is supported among others by Darrat (1998) and Demirhan and Demirhan(2013) for Turkey; Fuess et al. (2003) for Taiwan; Eita and Mbazima (2008) for Namibia; Apergi et al. (2012) for Greece; Al-Khulaifi (2012) for Qatar; Mohanty and Mishra (2017) for India.

The second hypothesis (spend-and-tax) also known as 'expenditure dominance hypothesis' is proposed by Peacock and Wiseman (1979). According to them, a temporary or permanent increase in government spending will sooner or later cause higher taxes. Thus, the causal ordering runs from spending to taxes. In consistent with this, Barro (1974) views that today's higher spending will be perceived as higher future taxes by rational tax-payers without causing fiscal illusion. This hypothesis suggests that budget deficit can be reduced by decreasing spending. Some of the studies which provide support for this hypothesis include Von Furstenberg et al. (1986) for the United States of America; Hondroyiannis and Papapetrou (1996) for Greece; Khundrakpam (2003) for India; Wahid (2008) and Dogan (2013) for Turkey; Carneiro et al. (2004) for Guinea-Bissau; Khalaf (2008) for Sweden; Saysombath and Kyophilavong (2013) for Lao PDR.

The third hypothesis advanced by Musgrave (1966) and Meltzer and Richard (1981) is known as the fiscal synchronization hypothesis. According to this hypothesis, the budgetary process is jointly determined by politicians and bureaucrats in a representative democracy where most of the budgetary items are routinely approved following the preceding year's allocation with minor departures in certain items after scrutiny (Hasan and Lincoln, 1977). Therefore, according to this view, it is expected to observe synchronization between government revenue and spending. 'Under the fiscal synchronization hypothesis, a government simultaneously chooses the desired package of spending programme and the revenues necessary to finance such spending programme' (Ewing et al., 2006). In an empirical sense, this implies a bi-directional causality between expenditure and revenue. The studies supporting this hypothesis include Das and Das (1998) for India; Li (2001) and Chang and Ho (2002) for China; Maghyereh and Sweidan (2004) for Jordan; Al-Qudair (2005) for Kingdom of South Arabia; Gounder et al. (2007) for Fiji; Nyamonga et al (2007), Lusinyan and Thornton (2007) and Ziramba (2008) for South Africa; HYE and Anwar (2010) for Romania; Nanthakumar et al. (2011) for Malaysia; Mehrara et al. (2011) for 40 Asian countries; Al-Zeaud (2012, 2015) for Jordan; Elyasi and Rahimi (2012) for Iran; Aregbeyen and Insah (2013) for Nigeria and Ghana; Antwi et al. (2013) and Takumah (2014) for Ghana.

As per 'institutional separation' or 'neutrality' hypothesis, there is no causal relationship between revenue and expenditure. Wildavsky (1988), Hoover and Sheffrin (1992), Baghestani and McNown (1994) argue that there could be no inherent relationship between the two as there is institutional separation in taking government spending and revenue decisions. This is supported by Dhanasekaran (1997) for India and Dada (2013) for Nigeria.

Empirical findings on the applicability of the above hypotheses have, therefore, shown large divergences between countries, and even inter-temporally within a country. Studies on individual country have mostly focused on the developed countries. However, in recent years the studies are also done in developing countries. But there are very few studies in India and at the state level. In the case of India, Das and Das (1998) using cointegration and Granger causality got bidirectional causality between nominal revenue and nominal expenditure. But they got support of spend-tax hypothesis when real values of the data were taken for the centre. Dhanasekaran (2001) validated spend-tax hypothesis using Granger Causality, while validated partially fiscal synchronization hypothesis using Geweke decomposition method.

Khundrakpam (2003) found spend-tax hypothesis in India by utilizing cointegration and error-correction modelling framework and through variance decomposition analysis and impulse responses. In contrast to above studies, at the India level Mohanty and Mishra (2017) find the evidence of tax-spend hypothesis by using Johansen-Juselius cointegration and Vector Error Correction Models. Using state level data in India, Bhat et al. (1991) find the evidence of fiscal synchronization hypothesis. Similarly, Naidu et al. (1995), using Granger and Sim-test of causality get support of fiscal synchronization hypothesis in the state of Andhra Pradesh. However, Bishnoi and Juneja (2016) show the evidence of tax-spend hypothesis in the state of Haryana.

3. Data and Methods

The present study uses data on per capita government revenue, per capita government expenditure and per capita net state domestic product over the period 1981-2017 to study the causal relationship between government revenue and government expenditure in Odisha. The per capita net state domestic product is added for a trivariate investigation to obviate variable omission bias. The expenditure and revenue data have been collected from the budget documents of the state, while the net state domestic product data have been sourced from the Directorate of Economics and Statistics, Government of Odisha through Indiastat. We have considered the nominal series of expenditure and revenue, as the budgetary exercises are usually undertaken in current prices. The summary of descriptive statistics of the variables is presented in Table 1. The models used to test for stationarity, co-integration and causality of the variables are presented in the following.

3.1 Test of Stationarity

Time series data are often found to be non-stationary in their levels and thus produce spurious results when used for regression analysis. Where time series data are found to be non-stationary, the method of differencing approach is applied to the series until they become stationary. The present study has used augmented Dickey Fuller (ADF), Phillips-Perron (PP) and DF-GLS tests to verify the stationarity of the variables. In carrying out this test, the null hypothesis is that the series contain unit root against the alternate hypothesis of no unit root. The variables are integrated of the order p, that is $I(p)$, if they are stationary at p th difference and integrated of the order 0, denoted as $I(0)$, if they are stationary at levels.

3.2 ARDL Bounds Test for Co-integration

To explore the existence of long-run relationship among the variables, ARDL bounds testing approach developed by Pesaran et al. (2001) is adopted. The ARDL model has the advantage of testing co-integration relationships irrespective of whether the underlying variables are $I(0)$, $I(1)$ or a combination of both, and is suitable for a small sample size. The optimal lags of the variables are selected by using Akaike Information Criteria (AIC), which is superior to other criteria and has less mean prediction error (Shahbaz, Kumar and Nasir, 2013). In the ARDL model, different variables may have different optimal number of lags.

ARDL representation of bounds testing given by the following unrestricted error correction (conditional error correction) models have been estimated to establish the long-run relationship between government revenue and expenditure.

$$\Delta LPCREV_t = \alpha_{10} + \sum_{i=1}^{p} \alpha_{11i} \Delta LPCREV_{t-i} + \sum_{i=0}^{q} \alpha_{12i} \Delta LPCTEXP_{t-i} + \sum_{i=0}^{r} \alpha_{13i} \Delta LPCNSDP_{t-i} + \beta_{11} LPCREV_{t-1} + \beta_{12} LPCTEXP_{t-1} + \beta_{13} LPCNSDP_{t-1} + \varepsilon_{1t} \quad (1)$$

$$\Delta LPCTEXP_t = \alpha_{20} + \sum_{i=1}^{p} \alpha_{21i} \Delta LPCTEXP_{t-i} + \sum_{i=0}^{q} \alpha_{22i} \Delta LPCREV_{t-i} + \sum_{i=0}^{r} \alpha_{23i} \Delta LPCNSDP_{t-i} + \beta_{21} LPCREV_{t-1} + \beta_{22} LPCTEXP_{t-1} + \beta_{23} LPCNSDP_{t-1} + \varepsilon_{2t} \quad (2)$$

Where LPCREV, LPCTEXP and LPCNSDP are logarithmic value of per capita government revenue, per capita total government expenditure and per capita net state domestic product respectively. p, q and r are lag orders. Δ denotes the first difference operator, α_{10} and α_{20} are the drift components and ε_{1t} and ε_{2t} are white noise error processes. α_{j1}, α_{j2} and α_{j3} are the short run coefficients, while β_{j1}, β_{j2} and β_{j3} are the long run coefficients.

The bounds testing approach is based on the *F*-statistic. The null hypothesis of 'no long-run relationship' is tested with the level of *F*-test of joint significance of the lagged level coefficients. The null hypothesis of no co-integration in each equation is $H_0 : \beta_{j1} = \beta_{j2} = \beta_{j3} = 0$. The estimated *F*-statistic is compared with the lower and upper critical bounds as the distribution of *F*-statistic is non-standard as proved by Pesaran et al. (2001). We do not reject the null hypothesis of no co-integrating relationship when *F*-statistic falls below the lower bound, i.e. $I(0)$. However, we reject the null hypothesis of no co-integrating relationship when the estimated *F*-statistic is greater than the upper bound, i.e. $I(1)$. The test is inconclusive when the *F*-statistic falls between the lower and upper bounds.

3.3 Granger Causality Test

According to Granger's theorem when the variables are co-integrated, the simple Granger causality is augmented with the Error Correction Term (ECT), derived from the residuals of the appropriate co-integration relationship to test for causality. A vector error correction model (VECM) is a restricted VAR designed for use with non-stationary series that are known to be co-integrated. The VECM has co-integration relations built into the specification so that it restricts the long-run behaviour of the endogenous variables to converge to their co-integrating relations while allowing for short-run adjustment dynamics. The co-integration term is known as the error correction term since the deviation from long-run equilibrium is corrected gradually through a series of partial short-run adjustments. Thus we estimate the following VECMs for the Granger causality test of the variables under study.

$$\Delta LPCREV_t = \alpha_0 + \sum_{i=1}^{m} \alpha_{1i} \Delta LPCREV_{t-i} + \sum_{i=0}^{m} \alpha_{2i} \Delta LPCTEXP_{t-i} + \sum_{i=0}^{m} \alpha_{3i} \Delta LPCNSDP_{t-i} + \alpha_4 ECT_{t-1} + \varepsilon_t \quad (3)$$

$$\Delta LPCTEXP_t = \beta_0 + \sum_{i=1}^{n} \beta_{1i} \Delta LPCTEXP_{t-i} + \sum_{i=0}^{n} \beta_{2i} \Delta LPCREV_{t-i} + \sum_{i=0}^{n} \beta_{3i} \Delta LPCNDSP_{t-i} + \beta_4 ECT_{t-1} + v_t \quad (4)$$

Where ε_t and v_t are mutually uncorrelated white noise errors, ECT_{t-1} expresses error correction term, and α_4 and β_4 are speed of adjustment to the equilibrium level after a shock. Lag orders m and n are chosen using Akaike Information Criteria.

This approach allows us to distinguish between 'short-run' and 'long-run' Granger causality. The Wald-tests of the 'differenced' explanatory variables give us an indication of the 'short-run' causal effects, whereas the 'long-run' causal relationship is implied through the significance of the t-test(s) of the lagged error correction term that contains the long-term information since it is derived from the long-run co-integrating relationship.

4. Results and Analysis

4.1 Unit root test

The results for stationarity of variables using ADF, PP and DF-GLS tests show that the variables LREV, LEXP and LNSDP are non-stationary at levels but stationary at first difference, i.e. they are integrated of order $I(1)$ (Table 2). Hence, the series have common integration order. Therefore, Johansen cointegration test can be applied here. However, ARDL bounds test for cointegration would be more suitable than Johansen cointegration test as the sample size is small besides the order of integration $I(1)$ less than $I(2)$.

4.2 Test for co-integration

In order to test the cointegration of the variables, the ARDL bounds testing method is used. The *F*-statistics together with the exact critical values are reported in Table 3 when Government Expenditure and Government Revenue are dependent variables in two models. The results show that when per capita government expenditure is the dependent variable, the calculated F-statistic (46.59) is higher than the upper critical bound (5.0) at 1% level of significance showing a long-run relationship between the variables. On the other hand, in the model when per capita government revenue is the dependent variable, the variables are not cointegrated as the calculated F-statistic (1.91) is less than the lower critical bound either at 1% level of significance (4.1) or at 5% level of significance (3.1).

The test of efficiency of the models is presented in Table 4. The Breusch-Godfrey test suggests that there is no serial correlation in the error term in the models. The ARCH test denotes that the errors are homoscedastic and independent of regressors. The models pass the test of functional form. Jarque-Bera normality test satisfies when expenditure is dependent variable, signifying that it is normally distributed. The models also appear stable over the period of estimation as the CUSUM and CUSUM of Squares test statistics remain within the critical bounds at 5% level of significance (Figures 2(a) and 2(b)).

The long run elasticity of government expenditure is estimated by using the unrestricted error correction model. From the results of long run elasticity of government expenditure it is revealed that income and revenue elasticities of expenditure are less than unity (Table 5), which shows that government expenditure responds less than proportionately to the change in government revenue and income. However, only revenue is a significant determinant of expenditure. The positive coefficient of revenue indicates thatexpenditure increases with the increase in revenue. It increases by 76 per cent with 100 per cent increase in revenue. Hence in the long run, government revenue plays a significant role in the growth of government expenditure.

The result of the short run elasticity of expenditure shows that it is revenue and income inelastic (Table 5). While income is an insignificant determinant of expenditure, revenue is a significant determinant. As expected there is positive relationship between expenditure and revenue. With 100 per cent increase in revenue, expenditure increases by 26 per cent in the short run. Hence, like long run, in the short run expenditure is influenced by revenue, while income does not play any significant role.

4.3 Test for causal relationship

The existence of co-integrating relationship between variables suggests that there must be Granger causality in at least one direction, but fails to signify the direction of causality between the variables. Hence, after establishing the co-integrating relationship between the variables when government expenditure is the dependent variable, the next step is to test for the causal relationship between the variables. Since the variables are co-integrated, the VECMs are estimated in order to find the direction of causality. The VECM not only provides an indication of the direction of causality, but also enables to distinguish between short-run and long-run Granger causality. In order to find the short-run causality, we test the effect of lagged differenced explanatory variables on the dependent variables using Wald F-test. On the other hand, to examine the long-run causality between the explanatory variables and the dependent variable, we test the significance of lagged error correction term using t-test.

The results show that the error correction term is significant when expenditure is the dependent variable. This indicates that long run causal relationship is running from revenue to expenditure (Table 6). At the same time, error correction term is not significant when revenue is the dependent variable. This reveals that there is unidirectional long-run causality between government revenue and government expenditure, where causality is running from revenue to expenditure. Hence, government revenue has significant impact on the expenditure in the long run in Odisha. This supports the tax and spend hypothesis. However, there is no evidence of causality between government expenditure and revenue in the short-run.

The coefficient of error correction term shows the speed at which the disequilibrium is corrected in the long run. The results from Table 6 reveal that the error correction coefficient is 0.195 when expenditure is the dependent variable, indicating that the disequilibrium is corrected by about 19.5 per cent per year. Hence, it takes about five years to correct the disequilibrium once there is a shock.

4.4 Tests for Sources of Variability

Granger causality test suggests which variables in the model have statistically significant impacts on the values of other variables in the system. However, the result will not be able to indicate how long these impacts will remain effective in the future. This paper conducts variance decomposition (proposed by Koop et al., 1996) and impulse response analysis (proposed by Pesaran and Shin, 1998) to study the dynamic relationship between Odisha's government revenue and expenditure in the future.

4.4.1 Variance Decomposition

The dynamic framework provided by VECM to test the long-run equilibrium is strictly within-sample test. It does not provide an indication of the dynamic properties of the system beyond the sample period. However, variance decomposition, which may be termed as out-of-sample tests, gives the proportion of movements in variance of the forecast errors of the dependent variables that are due to their own shocks versus shocks to the other variables. The results of variance decomposition over a period of 20-year time horizon are presented in Tables 7(a) and 7(b). Variance decomposition of government expenditure reveals that government revenue contributes increasingly and after 20 years explains 57 per cent of the government expenditure (Table 7a). On the other hand, variance decomposition of government revenue reveals that government expenditure contributes less than one per cent of government revenue even after 20 years (Table 7b). Therefore, results of the variance decomposition strengthen the outcome of the causality analysis. That is, unidirectional causality running from government revenue to expenditure still prevails in the forecast period.

4.4.2 Impulse Response

Figures 3(a) and 3(b) show impulse response analysis of the variables. The results show that 20 years analysis of one standard deviation positive shocks in government revenue will change government expenditure to rise positively, indicating that there is existence of causality from government revenue to government expenditure beyond the sample period (Table 3a). On the other hand, one standard deviation positive shocks in government expenditure will not change government expenditure even after 20 years. This strengthens the existence of unidirectional causality from government revenue to government expenditure in Odisha.

5. Conclusions

The paper has analysed causal relationship between revenue and expenditure of the government of Odisha over the period 1981-82 to 2016-17. The unit root test is performed to examine the stationarity of the time series. The ARDL bounds test approach is applied to test the existence of the long-run relationship between government expenditure and revenue. The vector error-correction (VEC) model is utilised to establish the Granger causality between government expenditure and revenue.

The results obtained from the trivariate model indicate that Odisha follows a policy of tax and spend, indicating that the spending decisions are determined by the revenue of the state government. That means with the increase in revenue, there is increase in expenditure. This relationship is stable in the long-run. This result coincides with the findings of Mohanty and Mishra (2017) for India and Bishnoi and Juneja (2016) for the state of Haryana who found that there is unidirectional causality from revenue to expenditure. At the same time, the result is at variance with findings of Das and Das (1998), Dhanasekaran (2001) and Khundrakpam (2003) for India, Bhat et al. (1991) for state level in India, and Naidu et al. (1995) for the state of Andhra Pradesh.

The causality from revenue to expenditure in Odisha reveals that Odisha is an economy where allocation of expenditure is decided on the basis of collection of revenue. Under this scenario, the fiscal authorities of Odisha should increase revenue and at the same time decrease expenditure to reduce the fiscal imbalance.

References

Al-Khulaifi, A. S. (2012). The relationship between government revenue and expenditure in Qatar: a cointegration and causality investigation. *International Journal of Economics and Finance, 4*(9), 142.

Al-Qudair, K. H. (2005). The relationship between government expenditure and revenues in the kingdom of Saudi Arabia: testing for cointegration and causality. *Journal of King Abdul Aziz University: Islamic Economics, 19*(1), 31-43.

Al-Zeaud, H. A. (2012). Government revenues and expenditures: causality tests for Jordan. *Interdisciplinary Journal of Contemporary Research in Business, 4*(7), 193-204.

Al-Zeaud, H. A. (2015). The causal relationship between government revenue and expenditure in Jordan. *International Journal of Management and Business Research,* 5(2), 117-127.

Antwi, S., Zhao, X., & Mills, E. E. (2013). Consequential effects of budget deficit on economic growth: empirical evidence from Ghana. *International Journal of Economics and Finance*, 5(3), 90-99.

Apergis, N., Payne, J. E., and Saunoris, J. W. (2012). Tax-spend nexus in Greece: are there asymmetries? *Journal of Economic Studies, 39*(3), 327-336.

Aregbeyen, O., and Insah, B. (2013). A dynamic analysis of the link between public expenditure and public revenue in Nigeria and Ghana. *Journal of Economics and Sustainable Development, 4*(4), 18-26.

Baghestani, H., and McNown, R. (1994). Do revenues or expenditures respond to budgetary disequilibria? *Southern Economic Journal*, October, 61(2), 311-322.

Barro, R. J. (1974). Are government bonds net worth? *Journal of Political Economy*, 82, 1095-1117.

Bhat, K. S., Nirmala, V., and Kamaiah, B. (1991). Causality between revenue and expenditure of Indian states, *Artha Vijnana*, 33(4), 335-344.

Bishnoi, N.K., and Juneja, T. (2016). An examination of interdependence between revenue and expenditure of government of Haryana, *The Indian Economic Journal*, 64 (1-4), 176–185.

Buchanan, J., and Wagner, R. E. (1977). *Democracy in deficit: the political legacy of Lord Keynes.* New York: Academy Press.

Carneiro, F., Faria, J. R., & Barry, B. S. (2004). Government revenues and expenditures in Guinea-Bissau: causality and cointegration. *World Bank Group Africa Region Working Paper Series No. 65*.

Chang, T. and Ho, Y.H. (2002). A note on testing tax-and-spend, spend-and-tax or fiscal synchronization: the case of China. *Journal of Economic Development, 27*(1), 151-160.

Dada, M. A. (2013). Empirical investigation of government expenditure and revenue nexus:implication for fiscal sustainability in Nigeria. *Journal of Economics and Sustainable Development*, 4(9), 135-142.

Darrat, A.F. (1998). Tax and spend, or spend and tax? an enquiry into the Turkish budgetary process. *Southern Economic Journal, 64*(4), 940-956.

Das, A., and Das, S. (1998). Temporal causality between government taxes and spending: an application of error correction models, *Prajnan*, 27(1), 37-46.

Demirhan, B., & Demirhan, E. (2013). The government revenue and government expenditure nexus: empirical evidence from Turkey. *International Journal of Economics and Management Sciences, 2*(10), 50-57.

Dhanasekaran, K. (1997). Cointegration and causality models: temporal causality between government revenue and expenditure in India. *Prajnan*, 26(1).

Dhanasekaran, K. (2001). Government tax revenue, expenditure and causality: the experience of India. *Indian Economic Review*, New Series, 36 (2), 359-379.

Dogan, E. (2013). Does "revenue-led spending" or "spending-led revenue" hypothesis exist in Turkey. *British Journal of Economics, Finance and Management Sciences, 8*(2), 62-70.

Eita, J. H., and Mbazima, D. (2008). The causal relationship between government revenue and expenditure in Namibia. MPRA Paper No. 9154.

Elaysi, Y., and Rahimi, M. (2012). The causality between government revenue and government expenditure in Iran. *International Journal of Economic Sciences and Applied Research, 5*(1), 129-145.

Ewing, B.T., Payne, J.E., Thompson, M.A., and Al-Zoubi, O.M. (2006). Government expenditures and revenues: evidence from asymmetric modeling. *Southern Economic Journal*, 73(1),190-200.

Friedman, M. (1978). The limitations of tax limitation. *Policy Review,* 5(78), 7-14.

Fuess, S. M., Hou, J.W. and Millea, M. (2003), Tax or spend, what causes what? Reconsidering Taiwan's experience, *International, Journal of Business and Economics, 2*(2), 109-119.

Gounder, N., Narayan, P. K., & Prasad, A. (2007). An empirical investigation of the relationship between government revenue and expenditure: the case of the Fiji Islands. *International Journal of Social Economics, 34*(3), 147-158.

Hasan, M., and Lincoln, I. (1997). Tax then spend or spend then tax? Experience in the UK, 1961-93. *Applied Economic Letters*, 4(4), 237-239.

Hondroyiannis, G. and Papapetrou, E. (1996). An examination of the causal relationship between government spending and revenue: a cointegration analysis. *Public Choice,* 89(3-4), 363-374.

Hoover, K.D. and Sheffrin, S.M. (1992). Causation, spending, and taxes: sand in the sandbox or the tax collector for the welfare state? *American Economic Review*, 82 (1), 225-248.

HYE, Q. M. A. and Anwar, J. M. (2010). Revenue and expenditure nexus: a case study of Romania. *Romanian Journal of Fiscal Policy*, 1(1), 22-28.

Khalaf, G. A. (2008). An illustration of the causality relation between government spending and revenue in Sweden. *Journal of Natural Sciences and Mathematics, 2*(1), 41-52

Khundrakpam, J. K. (2003). The causal relationship between government expenditure and revenue: the Indian case. *Prajnan*, 32(3), 187-205.

Koop, Gary, Pesaran, M.H., and Potter S.M. (1996). Impulse response analysis in nonlinear multivariate models. *Journal of Econometrics*, 74(1), 119-147.

Li, X. (2001), Government revenue, government expenditure and temporal causality: evidence from China, *Applied Economics, 33*(4), 485-497.

Lusinyan, L., & Thornton, J. (2007). The revenue□expenditure nexus: historical evidence for South Africa. *South African Journal of Economics, 75*(3), 496-507.

Maghyereh, A. and Sweidan, O. (2004). Government expenditure and revenue in Jordan: what causes what? Multivariate cointegration analysis, *Social Science Research Network Electronic Paper Collection.*

Mehrara, M., Pahlavani, M., & Elyasi, Y. (2011). Government revenue and government expenditure nexus in Asian countries: panel cointegration and causality. *International Journal of Business and Social Science, 2*(7), 199-207.

Meltzer, A.H., and Richard,S.F. (1981). A rational theory of the size of government. *Journal of Political Economy*, 89(5), 914-927.

Mohanty, A.R. and Mishra, B.R. (2017). Cointegration between government expenditure and revenue: evidence from India. *Advances in Economics and Business*, 5(1), 33-40.

Musgrave, R. (1966). Principles of budget determination. In H. Cameron and W. Henderson (eds.). *Public Finance Selected Reading*, New York: Random House, 15-27.

Naidu, C.R., Mohsin, Md., and Naidu, V.J. (1995). Government expenditure in Andhra Pradesh: an analysis of growth and determinants, *Prajnan*, 23 (3), 332-352, 1995.

Nanthakumar, L., Kogid, M., Sukemi, M. N., & Muhamad, S. (2011). Tax revenue and government spending constraints: empirical evidence from Malaysia. *China-USA Business Review,* 10(9), 779-784.

Nyamongo, M. E., Sichei, M. M., &Schoeman, N. J. (2007). Government revenue and expenditure nexus in South Africa. *South African Journal of Economic and Management Sciences,* 10(2), 256-268.

Peacock, A., and Wiseman, J. (1979). Approaches to the analysis of government expenditure growth. *Public Finance Review,* 7, 3-23.

Pesaran, H.M., and Shin, Y. (1998). Generalized impulse response analysis in liner multivariate models. *Economic Letters*, 58(1), 17-29.

Pesaran M.H., Shin Y., and Smith, R.J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics*, 16(3), 289–326.

Saysombath, P., and Kyophilavong, P. (2012). The causal link between spending and revenue: the Lao PDR. *International Journal of Economics and Finance*, 5(10), 111-115.

Shahbaz, M., Kumar, A., and Nasir, M. (2013). The effects of financial development, economic growth, coal consumption and trade openness on CO2 emissions in South Africa, *Energy Policy*. 61, 1452-1459.

Takumah, W. (2014). The dynamic causal relationship between government revenue and government expenditure nexus in Ghana. *International Research Journal of Marketing and Economics*, 1(6), 1-16.

Von Furstenberg, G. M., Jeffrey, G. R. and Jeong, Jin-Ho (1986). Tax and spend or spend and tax, *Review of Economics and Statistics*, 68(2), 179–188.

Wahid, A. N. M. (2008). An empirical investigation on the nexus between tax revenue and government spending: the case of Turkey. *International Research Journal of Finance and Economics*, 16, 46-51.

Wildavsky, A. (1988). *The new politics of the budgetary process*. Glenview, IL: Scott, Foresman.

Ziramba, E. (2008). Wagner’s law: an econometric test for South Africa, 1960□2006. *South African Journal of Economics,* 76(4), 596-606.

Table 1: Descriptive statistics over the period 1981-2017

Variable	Mean	Std. Deviation	Minimum	Maximum
Per capita Revenue (Rs.)	3782	4859.36	226	16491
Per capita Expenditure (Rs.)	4378	5159.21	278	19289
Per capita Net State Domestic Product (Rs.)	18788	19706.20	1827	69067

Table 2: Unit Root Tests of the Variables

Variable	ADF		Phillips-Perron		DF-GLS	
	Level	First difference	Level	First difference	Level	First difference
LPCREV	0.4157	-6.7103*	0.7619	-6.6608*	-0.1860	-4.7156*
LPCTEXP	0.1995	-7.4592*	0.2752	-7.2645*	1.4055	-4.0955*
LPCNSDP	0.2976	-8.8846*	0.5376	-8.9715*	-0.2585	-7.8535*

Note: *Indicates rejection of null hypothesis of unit root at 1 per cent level.

Table 3: ARDL Bounds Tests for Co-integration based on AIC

Dependent variable	Lag length	Function				F-statistics
LPCREV	1,1,0	LPCREV (LPCTEXP, LPCNSDP)				1.91
LPCTEXP	1,0,0	LPCTEXP (LPCREV, LPCNSDP)				46.59*
Asymptotical values for unrestricted intercept and no trend		1% I(0)	1% I(1)	5% I(0)	5% I(1)	
		4.13	5.0	3.1	3.87	

*indicates F-statistic is above the upper bound at 1% level of significance.

Table 4: Diagnostic test results

	Dependent variable: Revenue		Dependent variable: Expenditure	
	F-test	**LM test**	**F-test**	**LM test**
Serial Correlation (Breusch-Godfrey)	F(1,29) = 0.0026 (0.9598)	0.0031 (0.9555)	F(1,30) = 0.4519(0.5066)	0.5194 (0.4711)
Heteroscedasticity (ARCH)	F(1,32) = 0.3521 (0.5571)	0.3701 (0.5430)	F(1,32) = 1.5564 (0.2212)	1.5770 (0.2092)
Normality (Jarque-Bera)	NA	8.2302 (0.0163)	NA	2.9426 (0.2296)
Functional Form (Ramsey's RESET test)	F(1,29) = 0.0012 (0.9724)	0.0015 (0.9694)	F(1,30) = 0.0146 (0.9045)	0.0171 (0.8960)

Note: Figures in square brackets indicate p-value.

Table 5: Estimated long-run and short-run coefficients of Government Expenditure

	Short-run	**Long-run**
Income Elasticity	0.0759 (0.5392)	0.2191 (0.4985)
Revenue Elasticity	0.2638* (0.0054)	0.7611** (0.0109)
Constant	0.0318 (0.8163)	0.0917 (0.8220)

Note: (a) Figures in the parentheses indicate p-value

(b) * and ** indicate significant at 1% and 5% level of significance.

Table 6: Error Correction Model Results

	Lag length	Short-run causality			Long-run causality
		Δ(LPCREV)	Δ(LPCTEXP)	Δ(LPCNSDP)	ECT_{t-1}
Δ(LPCREV)	1	-	0.0548	0.1114	-0.0286
			(0.8148)	(0.5275)	(0.8467)
Δ(LPCTEXP)	1	-0.2319	-	0.1734	-0.1951*
		(0.1575)		(0.1767)	(0.0247)

Note: 1. Lag length is selected on the basis of AIC criteria.
2. Figures in parentheses indicate p-values
3. * indicate significant at 5% level

Table 7: Findings from forecast error variance decomposition

(a) Variance Decomposition of LPCTEXP:

Period	S.E.	LPCTEXP	LPCREV	LPCNSDP
1	0.024145	100.0000	0.000000	0.000000
2	0.030018	98.88872	0.065718	1.045564
3	0.036295	94.39254	4.768243	0.839217
4	0.042517	86.91797	12.46798	0.614052
5	0.049054	79.48711	19.93796	0.574934
6	0.055551	72.73713	26.73434	0.528538
7	0.062009	67.10958	32.34764	0.542773
8	0.068290	62.46836	36.97827	0.553365
9	0.074378	58.69200	40.73149	0.576518
10	0.080241	55.59690	43.80638	0.596721
11	0.085878	53.05055	46.33166	0.617789
12	0.091291	50.93472	48.42898	0.636305
13	0.096492	49.16267	50.18397	0.653360
14	0.101492	47.66443	51.66721	0.668359
15	0.106304	46.38715	52.93110	0.681753
16	0.110941	45.28905	54.01739	0.693567
17	0.115418	44.33776	54.95817	0.704063
18	0.119745	43.50761	55.77901	0.713374
19	0.123934	42.77827	56.50006	0.721673
20	0.127995	42.13342	57.13749	0.729087

(b) Variance Decomposition of LPCREV:

Period	S.E.	LPCREV	LPCTEXP	LPCNSDP
1	0.033580	100.0000	0.000000	0.000000
2	0.044982	99.27071	0.127278	0.602009
3	0.053896	99.29722	0.183422	0.519355
4	0.061799	99.28663	0.169135	0.544236
5	0.068907	99.31721	0.164004	0.518782
6	0.075415	99.33367	0.152847	0.513479
7	0.081457	99.35548	0.144159	0.500357
8	0.087117	99.37207	0.135556	0.492378
9	0.092457	99.38799	0.128315	0.483692
10	0.097523	99.40130	0.121824	0.476878
11	0.102352	99.41324	0.116223	0.470532
12	0.106973	99.42357	0.111285	0.465145
13	0.111409	99.43273	0.106965	0.460310
14	0.115680	99.44077	0.103146	0.456081
15	0.119802	99.44793	0.099768	0.452305
16	0.123790	99.45429	0.096761	0.448950
17	0.127656	99.45998	0.094074	0.445943
18	0.131409	99.46510	0.091661	0.443243
19	0.135059	99.46971	0.089487	0.440805
20	0.138613	99.47388	0.087519	0.438598

Figure 1: Trends in revenue and fiscal deficits in Odisha (% of GSDP)

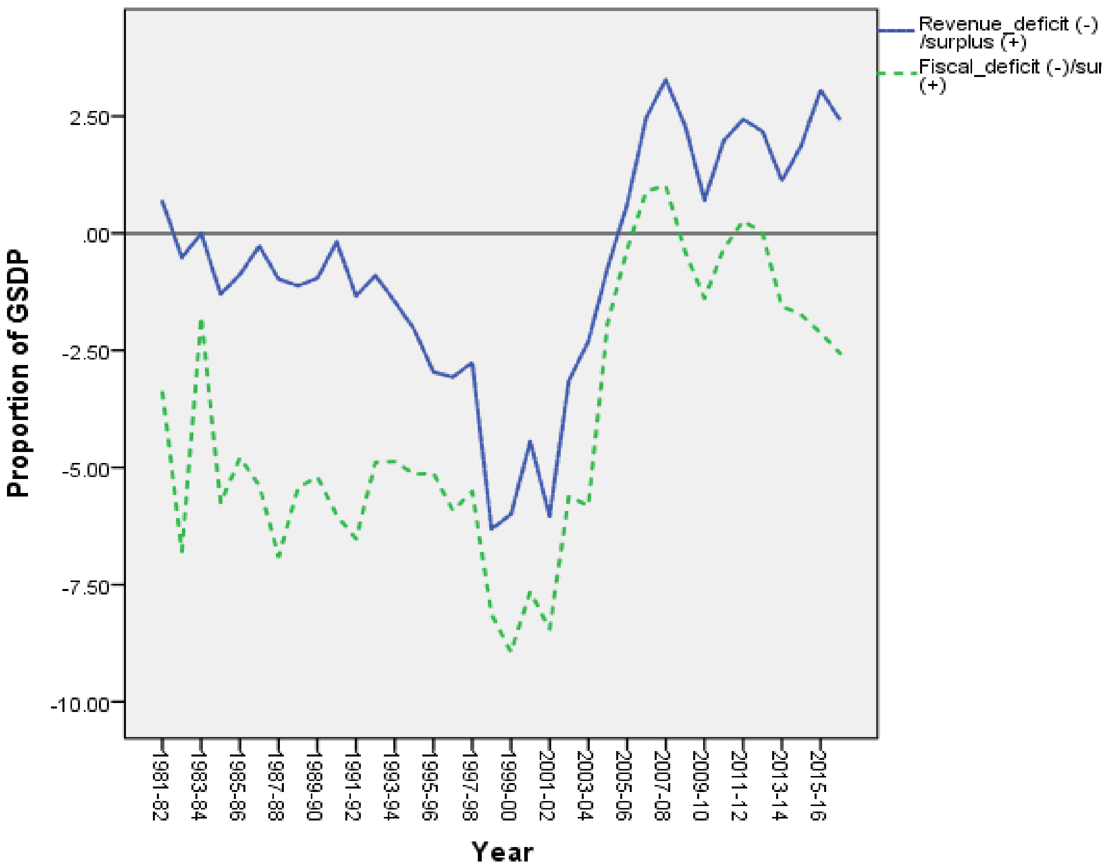


Figure 2(a): Stability tests for the equation with revenue as dependent variable

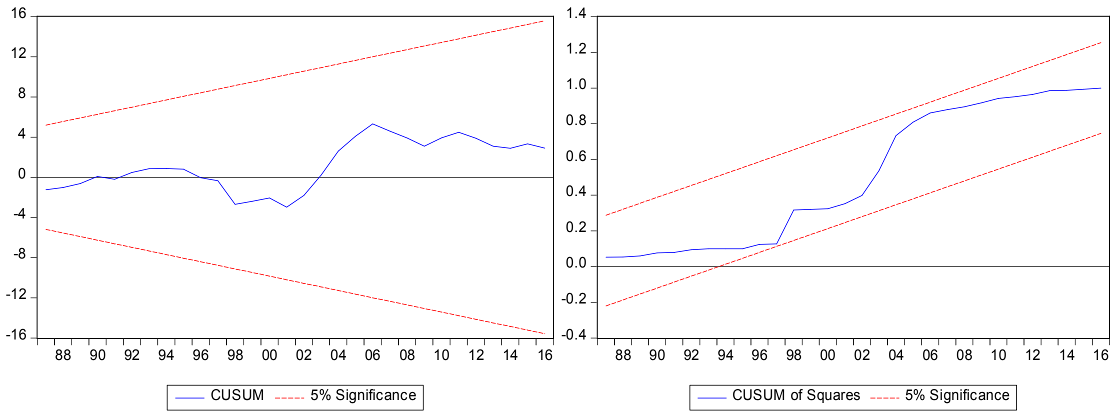


Figure 2(b): Stability tests for the equation with expenditure as dependent variable

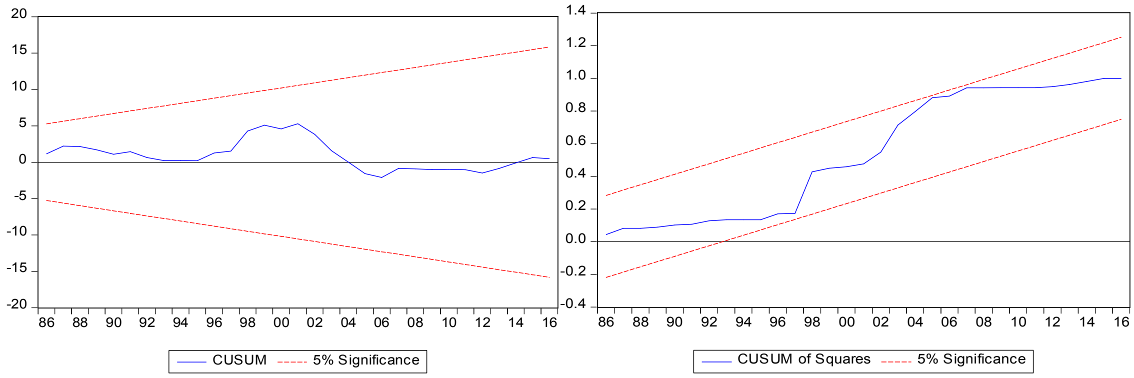


Figure 3(a): Impulse Response of Government Expenditure

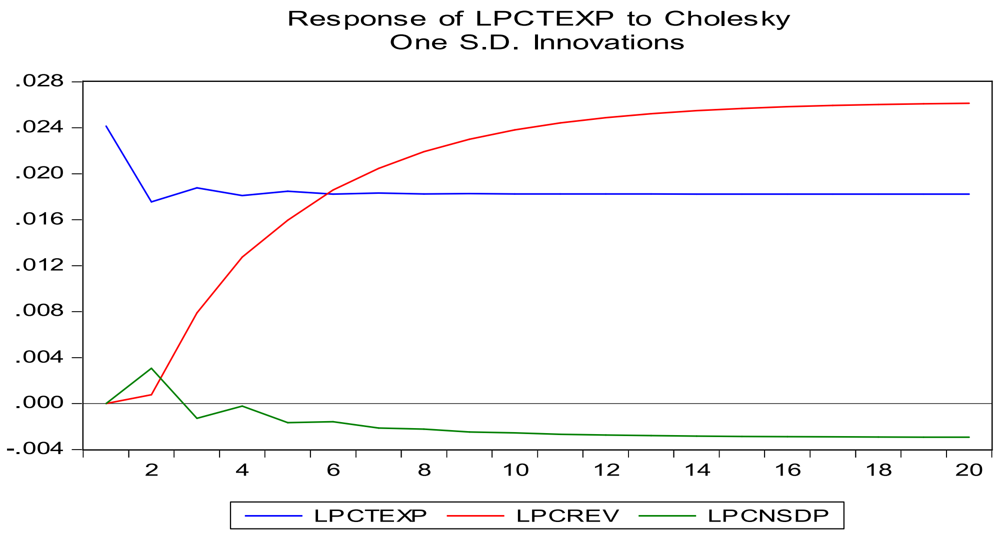
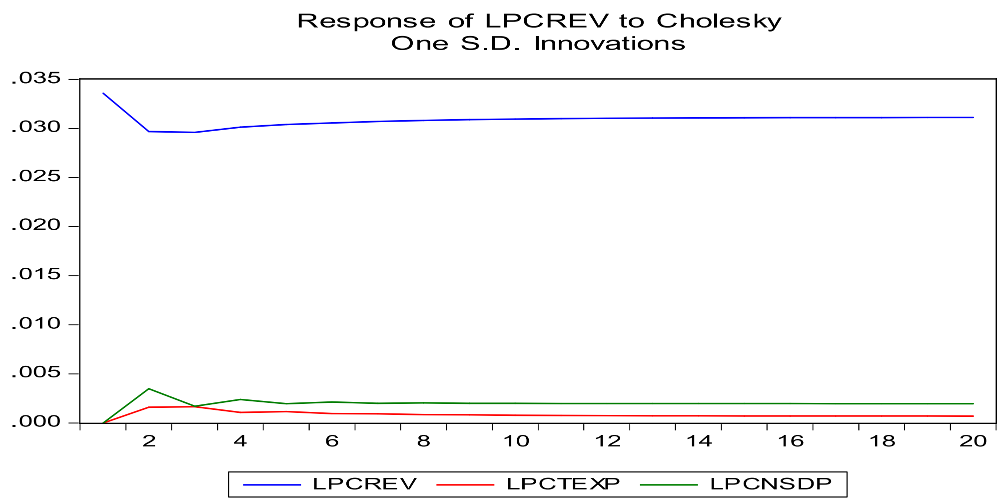


Figure 3(b): Impulse Response of Government Revenue



Nabakrushna Choudhury Centre for Development Studies (NCDS)
(an Indian Council of Social Science Research (ICSSR) institute
in collaboration with Government of Odisha)
Bhubaneswar - 751013
Odisha, India

Phone: +91-674-2301094, 2300471
Email: ncds_bbsr@dataone.in
Web: http://ncds.nic.in
Facebook: @ncdsbhubaneswar
Twitter Handle: @ncds_bbsr
Google Maps: NCDS Bhubaneswar