

Fiscal Capacity And Public Education Expenditure In Odisha: An ARDL Cointegration Analysis

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Abstract

Education builds a country's human capital, leading to inclusive economic development. This paper examines the impact of fiscal capacity on Odisha's public expenditure on education. The study relies on secondary sources of data like the annual financial statements of Odisha budget estimations from 1990-2024 and the RBI handbook. The study period is 1990-2024, where it tries to reflect what the major fiscal factors that influence education expenditure are. ARDL-ECM model has been used to see the influence of explanatory variables, whose result accepts a long-run relationship of the tax revenue and fiscal deficit of the state on its educational expenditure. The study takes the implementation of the SSA programme as a dummy variable that shows the relationship between the state and center's financial interconnection. The result advocates a long run relationship, where the dummy variable shows that the assistance of the central govt to the state through the SSA programme reduces the burden of education expenditure of Odisha. Policymakers should follow the education expenditure evidence to wisely utilise the fiscal funds in an appropriate way.

Keywords; *Fiscal capacity, Public expenditure, Education, Odisha, ARDL-ECM*

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I. Introduction

Education is the most important base for the economic and social development of any country. The educated and trained people of a nation can make the country profitable though being the populated one. Education can upgrade human resources through developed ideas, innovation, and improved capabilities. So, for the sake of developing human capital, public expenditure on education should be the priority. For social transformation and to meet sustainable development, the Government gives priority to spending on education. A study within 28 states of India explains the unidirectional relationship between the growth of the states and their respective public expenditures (Bhattacharyya, 2019). As per different education commissions and NEP 2020- the recent educational policy- the transformation in the education process and system requires a higher contribution of public fund is recommended. For many developing and underdeveloped country it is very essential to utilize public fund essentially in the path of capital formation through human development that can get induced through public expenditure on education. India is much focused on developing its education system by emphasizing different policies and programmes. Programmes like Rastriya Madhyamika Sikhsha Abhiyan, Sarva Sikhsha Abhiyan, New Education Policy etc. are examples of this. Through these initiatives, the Government aims to provide equitable access to everyone. But effective implementation of these initiatives requires an adequate amount of funding and the correct way of utilization of public fund. To achieve the objective of equitable and accessible education for all, public expenditure on education is a mandate. A study on 16 Indian states from 2001 to 2010 advocates that richer states spend more on their education purposes compared to poorer one (Chatterji, 2015). This appreciates a thought that states with good fiscal capacity can allocate their education spending effectively.

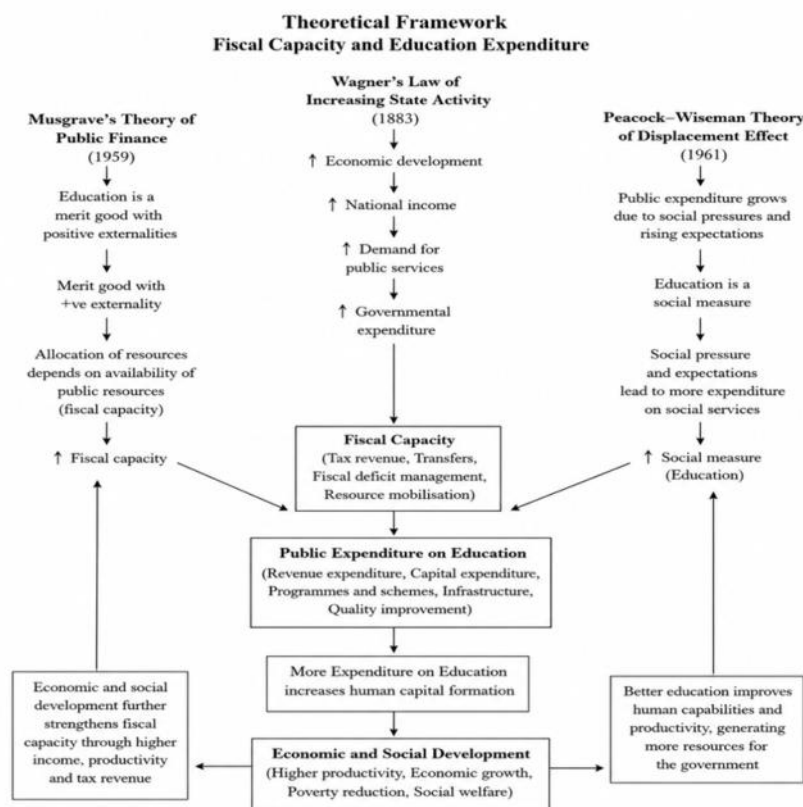
The study area, Odisha, is a state in eastern India. Over the last three decades, the state has seen different phases of economic development. For social sector development, the state government, along with the central government, has tried to make appropriate investments in different sectors like health, education, transportation, etc. The fiscal capacity of the state plays an important role in public expenditure on education. The higher the revenue it automatically induces higher investment in education, and a fiscal deficit causes stress for education expenditure. To make the educational system strengthened programmes like SSA needs wide coverage and much public expenditure in implementation. So studying about the factors that actually induce public expenditure on education in the state of Odisha is very essential. Many researches advocated various factors like national income, fiscal capacity, political factors, demographic conditions etc. determine the expenditure amount in education. Most of the studies are of international cross country level, where as the

research focusing upon the state odisha that to, for three decades, is limited. So, research on recent empirical studies of he short run and long-run determinants is essential.

To meet this research gap, the recent study aims to find out the relationship between fiscal capacity and public expenditure on education in Odisha by considering the empirical data from 1990-91 to 2023-24. It tries to study how public expenditure on education in Odisha is influenced by different fiscal factors like tax revenue and fiscal deficit. The influence of government policy on the public expenditure on education is also addressed here. The ARDL approach is used to measure both the short-run and long-run effects of these factors on public expenditure on education.

The research on Odisha will help policymakers to analyze the fiscal condition of the state and help to take decisions regarding wise investment in the education sector. It will also provide state based evidence regarding the public expenditure on education trend and will provide insights to develop policies accordingly.

Figure 1- Theoretical Framework



II. Review Of Literature

Along the economic theories a wide range of literature advocated the relationship between the fiscal capacity and public expenditure on education. Using cross-country evidence, Ram (1984) demonstrated that social sector expenditure contributes positively to economic growth through improvements in labour productivity and human capital. Yan, Qin, & Gong (2025) in their study explained that the share in public expenditure on education reduced because of the fiscal stress in 2002 in china. Gupta, Verhoeven and Tiongson (2002) found that higher public investment in education significantly improves educational outcomes and human development indicators in developing countries. Examining a large sample of developing economies, Bose, Haque and Osborn (2007) reported that productive public expenditure, particularly on education and social services, positively influences long-run economic growth. Murshed et al. (2020) advocated that a 1% increase in the fiscal capacity of a country causes 0.192% increase in the education expenditure in their study of cross country evidence (1990-2010). Baldacci et al. (2008) observed that sustained educational investment enhances human capital accumulation and strengthens long-term growth prospects. These studies collectively suggest that educational expenditure serves not only as a social investment but also as a catalyst for economic development. Gadenne (2015) in his study on Brazilian municipalities explained that the improvement in tax capacity of the municipalities led the administration to induce the expenditure on educational infrastructures in their area. A growing body of research has focused on identifying the factors that determine public expenditure

on education. Bussemeyer (2007), in a study of OECD countries, found that economic development, demographic characteristics and institutional arrangements influence government spending on education. Castles (1989) emphasized the importance of fiscal capacity and political commitment in shaping social sector expenditure. In the Indian context, Tilak (1993, 2008) argued that public financing remains essential for ensuring equitable access to education and noted that educational expenditure in India continues to remain below desirable levels despite substantial educational expansion. Patra and Acharya (2011) further reported a positive association between educational expenditure and economic growth in India, highlighting the developmental significance of sustained educational investment. Abel et al. (2025) in their study on Zimbabwe growth nexus, explained positive long run relationship between growth and education expenditure. Recent studies have increasingly examined the role of fiscal variables in influencing educational expenditure. Pradhan (2012) found that government revenue and fiscal performance significantly affect expenditure decisions across Indian states, while Mishra and Garg (2017) observed that stronger revenue mobilisation enhances the capacity of governments to invest in education and other social sectors. The role of centrally sponsored educational programmes has also attracted attention. Studies by Govinda and Bandyopadhyay (2010) and Jha and Parvati (2014) found that the Sarva Shiksha Abhiyan (SSA) significantly improved educational infrastructure, enrolment and access to elementary education, although its effectiveness depended largely on the fiscal capacity of state governments. Furthermore, Barro (1990) and Afonso and Jalles (2014) argued that persistent fiscal stress and fiscal consolidation measures may constrain government expenditure on productive sectors, including education.

III. Data And Methodology

The study is using annual time series data from 1990-91 to 2023-24 from secondary sources like Annual Financial Statements of the Government (1990-2025) and Annual Budget Reports- Department of Finance, Government of Odisha. RBI Handbook, MOSPI. The study period covers different changes in public expenditure on education patterns, fiscal capacities, and implementation of Government policy, that is, SSA.

Public expenditure on education is the dependent variable here. Tax revenue, Fiscal deficit, and grants from the central govt. through an education scheme (SSA) are the explanatory variables. Here, the implementation of the Government programme SSA (Sarva Shiksha Abhiyan) is used as a dummy variable. Tax revenue is used as the major factor influencing the state's internal financial resources. Gross fiscal deficit data reflects the fiscal stress and financial constraint. Grants from the central govt. are the financial assistance of the Central govt. to the state. The SSA is taken as the dummy variable to find out the policy intervention in the expenditure pattern. Logarithmic transformations are applied to exhibit the variations of the time series data.

To examine the determinants of public expenditure on education, the following functional relationship is specified: $EDN = f(TAX, FDR, \text{ and } SSA)$. Before considering the model, the ARDL stationary properties were tested through ADF (Augmented Dickey-Fuller). Considering the variables are stationary at 1(1), the ARDL model was finalized to be applied. The study run ARDL developed by Pesaran, Shin and Smith (2001) to study the long run and short run relationship between the explanatory and dependent variables. ARDL Bound test is used to review the long run relationship between the variables, where the H_0 supports no cointegration and H_1 suggests long run relationship between the variables. Greater F Statistics than the upper bound test result will advocate the long run relationship between variables. After cointegration coefficients Error Correction Model (ECM) is applied to highlight the short-run adjustments in the model towards the long-run relationship. For diagnostic test of the result various tests were conducted like Breusch-Godfrey Serial Correlation LM Test to examine autocorrelation in the residuals, to detect heteroscedasticity Breusch-Pagan-Godfrey is employed, Jarque- Bera test for normality of the residuals. To check the stability of the parameters, CUSUM and CUSUMSQ tests were used. The E-Views software is used to do all the statistical analysis.

- The general economic model- $LNEDN_t = \beta_0 + \beta_1 LNTAX_t + \beta_3 SSA_t + e_t$
- ADF regression Equation- $\Delta Y_t = a + \beta_1 + \gamma Y_{t-1} + \sum \delta_i \Delta Y_{t-i} + u_t$
- ARDL Model- $\Delta LNEDN_t + a_0 + \sum a_i \Delta LNEDN_{t-i} + \sum \beta_j \Delta LNTAX_{t-j} + \sum \gamma_k \Delta FDR_{t-k} + \sum \delta_i \Delta SSA_{t-i} + \lambda_1 LNEDN_{t-1} + \lambda_2 LNTAX_{t-1} + \lambda_3 FDR_{t-1} + \lambda_4 SSA_{t-1} + u_t$
- ECM Specification- $\Delta LNEDN_t = a_0 + \sum a_i \Delta LNEDN_{t-i} + \sum \beta_j \Delta LNTAX_{t-j} + \sum \gamma_k \Delta FDR_{t-k} + \sum \delta_i \Delta SSA_{t-i} + \psi ECT_{t-1} + u_t$

IV. Analysis And Interpretation

Table 1: Descriptive Statistics of the Variables

Statistics	LNEDN	LNTAX	FDR
Mean	5.9036	9.2699	1.9294
Median	5.6508	9.5060	1.9077
Maximum	7.9115	11.5671	4.7954
Minimum	3.8328	6.7299	-0.7230
Standard deviation	1.2333	1.5524	1.4866
Skewness	0.0429	-0.1965	0.1260

Kurtosis	1.7289	1.6778	2.2841
Jarque-Bera statistic	2.2995	2.6954	0.8161
Probability	0.3167	0.2598	0.6649

Source: Computed by the Author using EViews 13

Table 1 indicates the variations of the variables from 1990 to 2024 because there are significant changes throughout the years. The mean value shows the average value of Education expenditure (5.9), Tax revenue (9.2), and Fiscal deficit (1.9). The mentioned median values (5.6, 9.5 & 1.9) are very similar to the mean value, representing no significant deviation in the variables. The standard deviation value of Tax revenue is the highest among the three variables, which means there are greater fluctuations in it. The skewness value (nearly 0) suggests an approximate symmetry and the kurtosis (< 3) value indicates a platykurtic distribution.

Table 2: Augmented Dickey-Fuller (ADF) Unit Root Test Results		
Variable	p- value 1(0)	p- value 1(1)
LNEDN	0.8937	0.0025
LNTAX	0.8021	0.0000
FDR	0.4555	0.0000
SSA	0.5520	0.0000

Source: Computed by the Author using EViews 14

Table 2 shows the result of Augmented Dickey Fuller test results of Unit root. It shows that all the variables are stationary at their first difference, as the p value at level is not significant (> 0.05).

Table 3: ARDL estimation results			
Variable	Coefficient	T-Statistics	Probability
LNEDN(-1)	0.5817	3.9007	0.0007***
LNTAX	-0.0287	-0.2180	0.8293
LNTAX(-1)	0.4204	2.8630	0.0086***
FDR	0.0275	1.4707	0.1544
FDR(-1)	0.0034	0.1991	0.8439
FDR(-2)	-0.0362	-2.0703	0.0493**
SSA	-0.2732	-2.6757	0.0132**
Constant	-0.8370	-2.3245	0.0289**

***-significance at 1%

**_- significance at 5%

Source: author's computation using EViews

The Table 3 results that the lagged education variable and tax variable are highly significant at 1%. This explains that the current expenditure on education decisions is highly affected by the past year expenditure level and collected tax revenue. The current education expenditure increases by 0.42 % at every 1 % increase in the tax revenue of past year (coefficient 0.42). The Sarva sikhsha aviyaana programme variable highly influences the public education expenditure at 5% significant level with the coefficient by -0.27. The second lag of fiscal deficit is significant at 5% significance level and it shows the education expenditure is adversely affected by the earlier fiscal stress of the state. Other variables like current year tax and fiscal deficit are not significant. They show a limited short run influence on the education expenditure of the state.

Table 4: Ardl Bounds Test for Cointegration		
Test statistic	Value	
f-statistic	12.5136	
Critical bounds values		
Significance level	Lower bound I (0)	Upper bound I (1)
10%	2.676	3.586
5%	3.272	4.306
1%	4.614	5.966
Source: author's computation using EViews		

Source: author's computation using EViews

The Table 4 ARDL Bound test result in the Table shows that the F statistics (12.51) is much higher than the upper bound value at 1% (5.96), 5% (4.306), 10% (3.586). It rejects the null hypothesis which means there is a long run cointegration relationship between the dependent and independent variables. Despite some short run fluctuations the variables move along in the long run. The presence of cointegration will get more validated through the following ARDL ECM results.

Table 5: Long-Run Coefficients of the ARDL Model				
Variable	Coefficient	Std. Error	t-Statistic	Probability
LNTAX	0.9364	0.0494	18.9448	0.0000***
FDR	-0.0128	0.0375	-0.3400	0.7364

SSA	-0.6532	0.1626	-4.0172	0.0004***
Constant	-2.0009	0.3396	-5.8912	0.0000***

Source: Author's computation using EViews.

The long run cointegration equation: $LNEDN = -2.0009 + 0.9364LNTAX - 0.0128FDR - 0.6532SSA$

The cointegration results in Table 5 shows that approximately a 0.94% increase in the public expenditure on education is induced by 1% increase in the tax revenue of the state in the long run. Likewise the negative relationship between SSA program and education expenditure reflects the reduction in the state's education expenditure as the SSA expenditure improves. FDR does not show any significant long run relationship with public expenditure.

Table 6: Error Correction Model (ECM) Results				
Variable	Coefficient	Std. Error	T-Statistic	Probability
COINTEQ(-1)	-0.4183	0.0490	-8.5438	0.0000
D(LNTAX)	-0.0287	0.0824	-0.3482	0.7303
D(FDR)	0.0275	0.0128	2.1443	0.0408
D(FDR(-1))	0.0362	0.0132	2.7380	0.0106
R-squared	0.5060			
Adjusted R-squared	0.4531			
f-statistic	9.5610			
Prob (f- statistic)	0.000164			

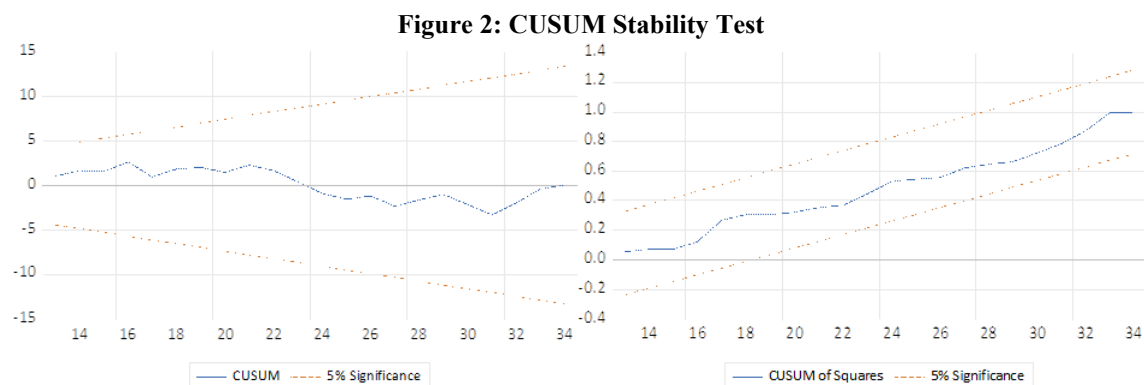
Source: Computed by the Author using EViews 14

The ECM Table-6 shows a highly significant error correction term (-0.4183) that explains 41.34% of the short run fluctuations are corrected each year. Any deviations from the long run equilibrium path comes back to track within about 2.4 years ($1/0.4183$). The short run changes in tax revenue do not influence the education expenditure but The fiscal deficit induces the educational expenditure in the short run. The lagged FDR also influences the education expenditure of the state positively in the short run. The diagnostic test of the residuals are explained through the following table.

Table 7: Diagnostic Test Results			
Diagnostic test	Test statistic	Probability value	Decision
Breusch-godfrey serial correlation Lm test (f- statistic)	2.5596	0.1001	No serial correlation
Breusch-pagan-godfrey Heteroskedasticity test (f- statistic)	0.7058	0.6673	Homoscedastic residuals
Jarque- bera normality test	0.4094	0.8149	Residuals normally distributed

Source: Computed by the Author using EViews 14

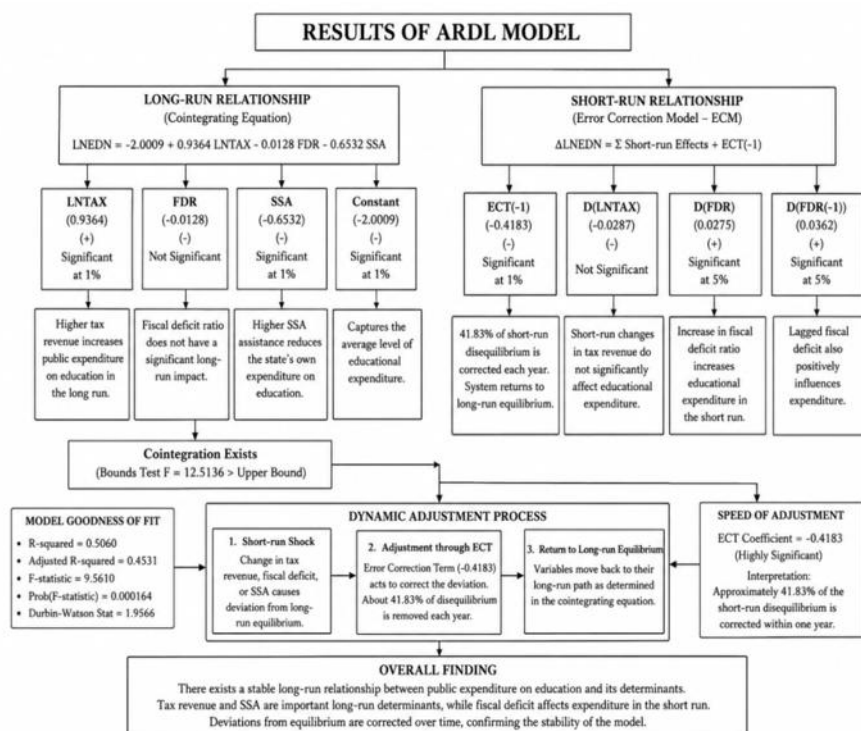
The diagnostic test result Table 7 shows that the residuals are free from autocorrelation, heteroskedasticity at 5% significance level. The Jarque-Bera test produced a probability value of 0.8149, which is greater than 0.05. The null hypothesis of normal distribution cannot be rejected, indicating that the residuals are approximately normally distributed. To study the stability CUSUM and CUSUMSQR test were employed.



Source: Author's computation using EViews 14.

In the Graph 2, both CUSUM and CUSUMSQ plot the blue line remains inside the 5% critical bounds throughout the time period. This explains the structural stability in the model.

V. Discussion



Tax Revenue-

Tax revenue is found to be an important determinant of education expenditure in the long run. The coefficient 0.93 indicates that the higher the tax revenue, the higher the expenditure inducement happens in social services expenditure, particularly on education. But as the tax revenue variables become insignificant in the short run, it shows that an increase in tax revenue does not immediately induce education expenditure, which may be due to budgetary procedures and the time required for incorporating additional revenue funds into the annual expenditure plan.

Fiscal Deficit Ratio-

The FDR ratio is not a sustainable source of education expenditure as it is insignificant in the long run. That means the education expenditure decision does not permanently rely on fiscal stress. But the positive significant coefficient in the short run indicates that education expenditure is induced by FDR in the short run. The Government prefers borrowing and deficit financing of educational expenses during immediate requirements. It shows the commitment of the Government towards maintaining the educational expenditure during fiscal stress.

Sarva Sikhsha Aviyan-

The SSA implementation shows that there is a significant negative relationship between the education expenditure and the educational programme in the long run. It is negative because it is a centrally sponsored scheme. As the center allocates financial assistance through the SSA programme, the state decides to allocate less to education expenditure. It shows the fiscal interaction between center and state's fiscal decisions.

Short-run & Long-Run Effects-

So there is a long run relationship (F- statistics- 12.53) between the education expenditure, tax revenue, fiscal deficit ratio, and the SSA Programme. The ECM result (-41.83) advocates that any correction in the equilibrium path get corrected in the year. It has a moderate speed of adjustment, as the magnitude of the coefficient suggests. The shocks that affect the education expenditure are not permanent; they gradually get corrected with time. The fluctuations in education spending in the short run were caused by the current fiscal stress and the implementation of the SSA programme by the central government. The govt. Education spending was fluctuated by the variations in tax revenue; fiscal stress also affected the expenditure pattern. However, the overall result suggests a highly significant long-run relationship between the variables.

VI. Conclusion And Policy Implications

The main purpose of the study was to examine the relationship between fiscal capacity and public expenditure on education in Odisha during the period 1990–91 to 2023–24 using the ARDL cointegration approach. The results advocated a stable long-run relationship between educational expenditure and fiscal factors. Tax revenue came out as the most significant determinant. While fiscal deficits influenced educational expenditure in the short run, their long-run impact was not significant. The study also found that the Sarva Shiksha Abhiyan contributed to changes in educational expenditure patterns. The government should make a sustainable mobilization of taxes to finance education expenditure. Policymakers should prioritise education expenditure without relying heavily on fiscal financing, as education expenditure induces human capital. Continuous evaluation and implementation of different educational schemes and policies like SSA should be encouraged, as it gives immense benefit to the inclusive economic development of the state.

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