Disaggregated Public Expenditure and Economic Growth: A Second-Generation Panel Data Analysis of Selected Indian States

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Abstract:

Public expenditure is an important fiscal instrument to achieve the Sustainable Development Goals. The endogenous growth theories have a notion that efficient public expenditure can boost the output level of the economy, irrespective of income levels and development stages. This study uses balanced panel data to investigate the impact of the components of development expenditure (social and economic services expenditures) and non-development expenditure (general services expenditure) on economic growth for the fourteen major non-special category Indian States from 1990-91 to 2020-21. The States are categorized into two panels, i.e., high and low-income. Using the Panel Dynamic Ordinary Least Square technique, the results of long-run estimates revealed that the components of development expenditure under the revenue expenditure account contribute to economic growth in both cross-section dependent and slope heterogenous sub-national panels. The component of non-development expenditure under the revenue expenditure account has a negative long-run relationship with economic growth for the high-income States' panel. The Dumitrescu & Hurlin Granger Causality results validate the two alternative propositions, supporting two opposite directions of causality, one connecting economic growth to the components of public spending (Wagner) and the other connecting the components of public expenditure to economic growth (Keynesian) in the short run. The components of development and non-development expenditures under the capital outlay account impact the economic growth of both the States' panels in the short run; however, the relationship disappears in the long run. These results highlight the problem of misallocation of capital outlay, which is more prone to corruption.

Keywords: *Economic Growth; Public Expenditure; Social, Economic, and General Services Expenditure; Second-generation Panel Data Analysis; High and Low-Income States.*

JEL Classification: *C33, H72, O11*

I. Introduction

The stability and growth of the economy largely depend upon public expenditure. The effect of public expenditure on economic growth (hereafter, EG) depends upon the nature and composition of public expenditure (Simiyu, 2015). The effect of government expenditure on the output level of the economy depends on what the government has spent the money on, the type, and how well the spent money is utilized and managed by the institutional mechanism (Seshaiah, 2018). Since India has chosen a federal structure, the sub-national level governments assist the central government in attaining equitable EG goals.

The concept of State government expenditure and EG nexus has been subjected to exploration. Theoretically, there are primarily two frameworks in this respect, one is the Wagner, and the other is the Keynesian approach. The former emphasizes the importance of EG over State expenditure to maintain economic equilibrium (Kalam & Aziz, 2009; Rehman, 2010; Samudram, 2009). Contrary, the Keynesian approach states that public expenditure is the principal determinant boosting EG (Dash & Sahoo, 2010; Dogan & Tang, 2011; Gangal & Gupta, 2013). The literature also witnesses the feedback relation between government expenditure and EG (Kumari & Sharma, 2017; Tiwari & Shahbaz, 2013; Ziramba, 2008). The empirical literature has also focused on the association of EG with the economic and functional classification[1] of public expenditure given by the International Monetary Fund (IMF). A plethora of literature shows contradictory results regarding the association between EG and the economic classification of budgetary spending (Egbetunde & Fasanya, 2013; Sharma, 2019; Kharel & Adhikari, 2021). The nexus between EG and the functional form of public expenditure has also shown mixed results (Ebong, 2016; Eggoh J. et al., 2015; Ray & Sarangi, 2021). Hence, the existing literature lacks a consensus regarding the nature of the association between economic and functional classification of budgetary expenditure and EG.

This study focuses on decomposing the compositions of development and non-development expenditures, i.e., social, economic, and general services expenditures under revenue expenditure and capital outlay[2], and measured its long-run (hereafter, LR) effect on EG. Unlike the previous studies conducted on the Indian States, this study focuses only on the Non-Special Category (hereafter, NSC) major Indian States[3], which do not get benefits that special category States receive from the Central government based on social, economic, and geographical terms. The studies previously conducted on the major Indian States have taken both categories simultaneously, which should not be considered technically. For comprehensive understanding, the sub-nationals are categorised into two panels[4], i.e., high-income States (hereafter, HYS) and low-income States (hereafter, LYS). The comprehensive results obtained from the study could help understand the government of Indian sub-nationals to re-strategies their expenditures, which are not contributing to or impeding their EG.

The remaining paper is drafted as below: The model and estimation methods are mentioned in Section II. The empirical results and discussion are shown in Section III. The paper finishes with Section IV, the conclusion, and policy implications.

II. Model and Estimation Methods

The study used yearly balanced panel data for the fourteen major NSC Indian States, which covers the period from 1990-91 to 2020-2021. 'One best part of using annual data is it is hardly sensitive to seasonal and cyclical fluctuations' (Singh & Sahni, 1984). The analysis period is based on the consistent data available for the variables. The data for the dependent variable, per capita (hereafter, PC) real NSDP, is obtained from the Handbook of Statistics on Indian Economy- an annual publication by the Reserve Bank of India (RBI). The data for the components of State government expenditure, i.e., social, economic, and general services expenditure under the revenue expenditure and capital outlay accounts, is obtained from various annual and occasional publications by RBI, specifically, the State Finances: A Study of Budgets, Handbook of Statistics on State Government Finances- 2004, and Handbook of Statistics on State Government Finances- 2010. The nine independent variables used in the study are Revenue Social Services Expenditure (RSSE), Capital Social Services Expenditure (CSSE), Revenue Economic Services Expenditure (RESE), Capital Economic Services Expenditure (CESE), Revenue General Services Expenditure (RGSE), Capital General Services Expenditure (CGSE), Total[5] Social Services Expenditure (TSSE), Total Economic Services Expenditure (TESE), Total General Services Expenditure (TGSE). All the independent variables are transformed in PC terms. The natural log form (ln) of all the variables is taken to remove differences in the variables across States. Using State-level deflators, i.e., the Gross State Domestic Product (GSDP) deflator, all the State government expenditure variables are converted into real terms.

Model Specification

From a theoretical perspective, in this study, we tried to examine the effect of State government expenditures on EG. The Model is represented by equation (1):

$$lnNSDP_{it} = \alpha_0 + \beta_1 \, lnX_{1it} + \beta_n \, lnX_{nit} + \mu_{it}$$

Here, $NSDP_{it}$ represents the dependent variable, Net State Domestic Product, which measures EG for the 'i' sub-national in the 't' time span. The pre-fix 'ln' represents the natural logarithm form of all the variables. α_0 represents intercept. X_{1it} and X_{nit} represent independent variables, i.e., government expenditure for the 'i' sub-national in the 't' time span. β_1, β_n represent coefficients of the independent variables. In this study, the following four log-log Models have been tested as follow:

Model I: $lnNSDP_{it} = f\,(lnRSSE_{it};\ lnCSSE_{it})$

Model II: $lnNSDP_{it} = f\,(lnRESE_{it};\ lnCESE_{it})$

Model III: $lnNSDP_{it} = f\,(lnRGSE_{it};\ lnCGSE_{it})$

Model IV: $lnNSDP_{it} = f\,(lnTSSE_{it};\ lnTESE_{it};\ lnTGSE_{it})$

Econometric Methods-

- **Summary Statistic:**

The study begins with the summary statistics for both the States' panels under consideration. The mean and median values show the dataset's high accuracy as these are within the range of minimum and maximum values. The variables are not bell-shaped, as indicated by the values of skewness and kurtosis. 'However, violating the normality assumption is not crucial, particularly for a large panel dataset' (Olaoye, 2019) (See Appendix A). The study then progresses to ascertain the CSD for all the selected variables used in the study.

- **Cross-section Dependent (CSD) Test:**

For the analysis of the panel data set, it is imperative to ascertain the presence of cross-section dependence (hereafter, CSD). 'The cross-section dependence explains the unidentified mutual shocks, geographical effects, or interactions within social networks, which becomes part of the error term' (Baltagi, 2016). Ignoring and applying the first-generation test (Standard order integration and cointegration tests) can produce biased, invalid test statistics, estimator inefficiency, probability of rejecting the true hypothesis, and inconsistent results (Iheonu, 2019). To check the existence of CSD, we follow the following CD statistic, which checks the average of pair-wise correlation coefficients of OLS residuals from the standard individual regression in the panel data set (Pesaran, 2004).

$$CD = \sqrt{\frac{2T}{N^2 - N}} \left(\sum_{i=1}^{N-1} \sum_{k=i+1}^{N} \rho_{ik} \right) \quad (2)$$

Where, $\widehat{\rho_{ik}}$ finds the pair-wise correlation in residuals from the sample estimated using the basic ordinary least square regression. The null hypothesis (H_0) shows the independence of the cross-section, whereas the alternative hypothesis (H_1) shows CSD. The results reject the (H_0) and conclude that all the variables are CSD at a 1 % significance level in both panels (See Appendix B).

- **Slope Heterogeneity (SH) Tests:**

Like the CSD test, it is vital to test the SH of the panel data set. For this purpose, Hashem and Yamagata (2008) SH test is used. This method is suitable for CSD, large time periods and small cross-sections, i.e., T > N. The (H_0) is slope homogeneity against the (H_1) of slope heterogeneity. The equations for the SH test are given below:

$$\bar{\Delta} = \sqrt{N} \left(\frac{N^{-1}\bar{S} - k}{\sqrt{2k}} \right) \sim X_k^2 \quad (3)$$

$$\bar{\Delta}_{adj} = \sqrt{N} \left(\frac{N^{-1}\bar{S} - k}{v(T,k)} \right) \sim N(0,1) \quad (4)$$

Here $\bar{\Delta}$ and $\bar{\Delta}_{adj}$ Implies delta tilda and adjusted delta tilda, respectively.

The tests result reject the (H_0) and deduce heterogeneity exists across sample States (See Appendix C). Thus, we should apply heterogeneous or second-generation panel techniques.

- **Second-generation Panel Unit Root Integration tests:**

Upon ascertaining the presence of CSD and slope heterogeneity (hereafter, SH), the study then progresses to ascertain the variables' correct integration order. 'In the presence of cross-section dependency and slope heterogeneity, the conventional unit root tests possibly over-reject the null hypothesis (H_0) and produce ineffective results' (Levin et al., 2002). In contrast, the second-generation methodology accounts for CSD. The present study uses the second-generation panel integration test called Cross-sectional augmented IPS and Cross-sectional augmented Dickey-Fuller test (Pesaran, 2007). The CADF test statistic is shown in Eq (5) as follows:

$$\Delta Y_{it} = \beta_i + \alpha_i y_{i,t-1} + b_i \bar{y}_{t-1} + d_i \Delta \bar{y}_t + \mu_{it} \quad (5)$$

Adding one time lag in the result of Eq (5) generates Eq (6) mentioned below:

$$\Delta Y_{it} = \beta_i + \alpha_i y_{i,t-1} + b_i \bar{y}_{t-1} + \sum_{k=0}^{j} \gamma_{ik} \Delta \bar{y}_{t-k} + \sum_{k=1}^{j} \delta_{ik} \Delta y_{i,t-k} + \mu_{it} \quad (6)$$

Here, $\bar{y}_{t-k}$ and $\Delta y_{i,t-k}$. It represents the average of each cross-section's lagged I (0) and the I (1) from each unit. 'The statistics of CIPS are obtained by calculating the average of the CADF statistics' (Usman, 2021). The statistics of the CIPS test are expressed in Eq (7) as follows:

$$CIPS = \frac{1}{N}\sum_{i=1}^{N} t_i\left(N,T\right) \qquad (7)$$

Here, the term $t_i(N,T)$ Can be re-write to represent the CADF Eq (8).

$$CIPS = \frac{1}{N}\sum_{i=1}^{N} CADF_i \qquad (8)$$

The findings of the tests mutually consensus that all the variables are stationary either at level, i.e., I (0), or first difference, i.e., I (1), for both the States' panels. Thus, both tests ensured that no variable in the present dataset was stationary at the second difference, i.e., I (2) (See Appendix D).

- **Long-run Estimates:**

Once the correct order of integration is confirmed, the empirical panel data analysis proceeds to check the LR association between the variables. We applied the Panel Dynamic Ordinary Least Squares (PDOLS) method augmented by Pedroni (2001), which supports the abovementioned features. It augments basic individual time series Dynamic Ordinary Least Squares (DOLS), which considers the endogeneity problem. It performs well with mixed orders of integration, i.e., I (0) and I (1). Moreover, the group-mean PDOLS takes care of CSD in the panel data set and gives robust results in case of omitted variable bias arising in the cointegration relationship. The equation for DOLS is as follows:

$$Y_{it} = \alpha_i + \beta_i X_{it} + \sum_{j=-k_i}^{k_i} \gamma_{ij}\Delta X_{it-j} + \mu_{it} \qquad (9)$$

Where Y refers to the log form of PC real NSDP, X refers to the log form of real State expenditure, βi represents the slope coefficient, 'i' refers to the number of sample sub-nationals in the panel data set, 'j' refers to the number of lags, and 'k' refers to the number of periods. The t-statistic & β slope coefficients are averaged using Pedroni's group means test for the whole panel data.

$$\hat{\beta} = N^{-1}\sum_{i=1}^{N} \beta_i \qquad (10)$$

Where, $(\widehat{\beta_i})$ is the standard DOLS estimator for the 'i' panel's entities.

- **Causality Test:**

The present study used a panel Granger causality test to check the short-run (hereafter, SR) causal mechanism among the analysed variables, also known as Dumitrescu and Hurlin (2012) test. This method augments the Granger (1969). The test's (H_0) assumes no causal relationship among the variables, and vice-versa for the (H_1). This test accounts for the CSD and provides robust results in case of large periods and small heterogenous cross-section balanced panel data sets. The equation is as follows:

$$C_{it} = \alpha_i + \sum_{p=1}^{r} \gamma_i^p C_{it-p} + \sum_{p=1}^{r} \eta_i^p X_{it-p} + \mu_{it} \qquad (11)$$

Here, 'p' shows the lag length, γ_i^p and η_i^p Denotes the regression and autoregressive parameters' coefficients. The findings obtained from applying the second-generation macro-econometric approach are presented in the succeeding section.

III. Empirical Results & Discussion

- **Long-run Estimates Results**

Using four Models each for both the States' panels, Table 1 represents the long-term association between the components of development and non-development expenditures and EG. The R-squared is significant, and the value is 99.18 % for the HYS panel, which means independent variables (development and non-development expenditures) explain 99.18 % of the variation or change in the dependent variable (EG). Similarly, it is 99 % for the LYS panel.

The results of Model I, for the panel of HYS, demonstrate that a 1 % rise in PC real RSSE results in a 0.39 % rise in PC real NSDP. This result is significant at a 1 % level. Similarly, for LYS, the results reveal that a 1 % rise in PC real RSSE results in a 0.31% rise in PC real NSDP. This result is significant at a 1 % level. This result supports the findings of Nworji (2012), who found a positive and significant relationship between SSE under revenue expenditure and EG in Nigeria. However, PC real CSSE is positive but insignificant for both the States' panels. The results align with Akpan and Abang (2013), who found an insignificant relationship between capital expenditure and EG.

The same scenario is seen in the case of Model II for both the categorised States' panels. The result shows that PC real RESE is significant at a 1 % significance level, which is 0.15 % and 0.19 %, respectively, for HYS and LYS panels. However, like Model I, the PC real CESE is insignificant for both panels—the results supported by Gong and Zou (2002) found an insignificant relationship between capital expenditure and EG.

The results for model III show a negative relationship for both the States' panels. In the case of the HYS panel, a 1 % rise in PC real RGSE results in a 0.19 % reduction in PC real NSDP. This result is significant at a 1 % level. However, PC real CGSE is positive but insignificant for both the panels of the States.

In Model IV, PC real TSSE positively affects the PC real NSDP for the HYS and LYS panels. The result is significant at a 1% level. The effect is comparatively higher for the HYS (0.26 %) than for LYS (0.22 %). For the HYS panel, a 1 % rise in PC real TESE results in a 0.10 % rise in PC real NSDP. This result is significant at a 5 % significance level. Whereas for the LYS panel, a 1 % increase in PC real TESE results in a 0.11 % increase in PC real NSDP. This result is significant at a 1% significance level. Thus, development expenditure has a significant positive effect on EG for both the States' panels. The results are consistent with the findings of Alexiou (2009), which also found a direct relationship between development expenditure and EG. On the other hand, in non-development spending, in the case of the HYS panel, a 1 % rise in PC real TGSE results in a 0.18 % fall in PC real NSDP. This result is significant at a 1 % significance level, which is insignificant for the LYS panel.

Table 1 Results of Panel DOLS

Dependent lnNSDP	High-Income States				Low-Income States			
	Model I	Model II	Model III	Model IV	Model I	Model II	Model III	Model IV
lnRSSE	0.392*	--	--	--	0.313*	--	--	--
lnCSSE	0.017	--	--	--	0.021	--	--	--
lnRESE	--	0.151*	--	--	--	0.192*	--	--
lnCESE	--	0.019	--	--	--	0.008	--	--
lnRGSE	--	--	(-) 0.189*	--	--	--	(-) 0.031	--
lnCGSE	--	--	0.030	--	--	--	0.040	--
lnTSSE	--	--	--	0.262*	--	--	--	0.221*
lnTESE	--	--	--	0.098**	--	--	--	0.115*
lnTGSE	--	--	--	(-) 0.181*	--	--	--	0.065
			R^2	0.991			R^2	0.990

Source: Researcher's calculation based on RBI data.
*Note: Asterisks * and ** represent 1 % and 5 % significance levels, respectively.*

Table 2 Results of (DH) Causality Test

Causality & Direction	High-Income States $\bar{W}$	$\bar{Z}$	p-value	Relationship	Low-Income States $\bar{W}$	$\bar{Z}$	p-value	Relationship
lnTSSE →lnNSDP	0.152***	-1.695	0.090	Bi-causal	2.151**	1.995	0.046	Bi-causal
lnNSDP →lnTSSE	10.633*	19.267	0.000		6.544*	9.603	0.000	
lnTESE →lnNSDP	0.913	-0.172	0.862	Uni-causal	5.488*	4.272	0.000	Bi-causal
lnNSDP →lnTESE	9.439*	16.878	0.000		6.235*	9.068	0.000	
lnTGSE →lnNSDP	0.506	-0.987	0.323	Uni-causal	1.703	1.218	0.222	Uni-causal
lnNSDP →lnTGSE	1.907**	1.814	0.069		3.189*	3.793	0.000	
lnRSSE →lnNSDP	0.401	-1.196	0.231	Uni-causal	1.609	1.055	0.291	Uni-causal
lnNSDP →lnSSE	10.879*	19.758	0.000		6.961*	10.324	0.000	
lnESE →lnNSDP	1.083	0.166	0.868	Uni-causal	0.487	-0.888	0.374	Uni-causal
lnNSDP →lnESE	9.236*	16.472	0.000		8.991*	13.842	0.000	
lnGSE →lnNSDP	0.56	-0.878	0.379	No	1.554	0.96	0.337	Uni-causal
lnNSDP →lnGSE	1.805	1.611	0.107		3.289*	3.966	0.000	
lnCSSE →lnNSDP	1.164	0.328	0.742	Uni-causal	2.884*	3.264	0.001	Bi-causal
lnNSDP →lnCSSE	4.680*	7.361	0.000		6.317*	9.209	0.000	
lnCESE →lnNSDP	1.825***	1.65	0.098	Bi-causal	7.831*	7.141	0.000	Bi-causal
lnNSDP →lnCESE	4.665*	7.33	0.000		2.876*	3.249	0.001	
lnCGSE →lnNSDP	2.265**	2.531	0.011	Bi-causal	2.014***	1.756	0.079	Bi-causal
lnNSDP →lnCGSE	5.219*	8.439	0.000		5.119*	7.135	0.000	

Source: Researcher's calculation based on RBI data.
*Note: Asterisks *, **, and *** represent significance at the 1 %, 5 %, and 10 % levels, respectively.*

- **Causality Test Results**

Table 2 reveals that there is a homogeneous bi-causal relationship between PC real NSDP and PC real TSSE in both the States panels. A unidirectional relationship exists between PC real NSDP to PC real TESE and TGSE for both the States' panels.

These results are consistent with the findings of Kumar and Hazarika (2022) and Rehman et al. (2010), who also found a bi-directional causal relationship between public expenditure and EG. However, the relationship between PC real NSDP and PC real TESE is an exception, which is bi-causal for LYS.

The relation between EG and PC real RSSE, RESE, and RGSE is unidirectional for both the States' panels. However, there is no relationship between PC real NSDP and PC real RGSE for HYS, which is aligned with the LR relationship. There is a bilateral causal relationship between PC real NSDP and capital outlay components of the spending for both the States' panels, except PC real CSSE, which has a one-way relationship from growth to States' expenditure for the HYS panel.

Hence, in the SR, the result validated the two alternative propositions, supporting two opposite directions of causality, one connecting EG towards public spending (Wagner's proposition) and the other connecting public expenditure towards EG (Keynesian proposition).

IV. Conclusion & Policy Implications

Using the disaggregated approach, this study investigates if the components of State spending have an impact (positive/negative) or not on the EG of the major NSC States in India from 1990-91 to 2020-21. Two States' panels, HYS and LYS, were used to understand the effect of State expenditure on EG. In a nutshell, the results validated the two alternative propositions, supporting two opposite directions of causality, i.e., Wagner's and Keynesian propositions in the SR. The compositions of States' development expenditure (PC real SSE and ESE) under the revenue expenditure do not have a significant impact in the SR. However, it impacts the EG of both the States' panels in the LR. On the contrary, the compositions of States' development expenditure (PC real SSE and ESE) under the capital outlay have a significant impact in the SR; however, their significant impact on the EG disappears from both the States' panels in the LR.

Surprisingly, theoretically but not empirically, in developing countries, revenue expenditures are productive at the margin (Devarajan et al., 1996; Kweka & Morrissey, 2000). One plausible explanation may be the misallocation of capital outlay, which is more prone to corruption. It may be because the State's spending is not always directly proportionate to the State's growth rate. 'When the size of government spending is smaller than the threshold regime, EG promotes; however, if government spending is larger than the regime, economic growth decreases' (See Appendix E, Rahn Curve). Thus, if the government expenditure is utilized in excess amount, the productive expenditure becomes unproductive at the margin" (Attari & Javed, 2013). Thus, productivity, not the type and the level of investment, is important (Kweka & Morrissey, 2000).

Hence, both the State governments' panels should rethink and formulate their policy more mindfully. The governments should cut or reduce the spending on the projects that have not contributed to or impeded EG. The State governments should re-adjust the spending priority so that the insignificant and negative impact of the variables could become significant so that it complements and improves private sector competition for overall EG. There should be high accountability and transparency in the State government spending, and spending should be monitored closely to check embezzlement and diversion of funds.

Note

1. The Government Financial Statistics database of the IMF classifies government expenditure into two types: (i) the economic classification based on economic characteristics of expenditure, i.e., revenue and capital expenditure. (ii) the functional classification based on the functions of the expenditure, i.e., social services, economic services, general services, and others.
2. The capital outlay is part of the State's total capital expenditure. It has two components, i.e., development and non-development expenditure. The development expenditure has two sub-components, i.e., social and economic services expenditures. At the same time, non-development expenditure has a component, i.e., general services expenditure.
3. The fourteen major NSC States of India taken for the study are Haryana (HR), Maharashtra (MH), Punjab (PB), Karnataka (KA), Kerala (KL), Tamil Nadu (TN), Gujarat (GJ), Andhra Pradesh (AP), Rajasthan (RJ), West Bengal (WB), Odisha (OD), Madhya Pradesh (MP), Uttar Pradesh (UP), Bihar (BR).
4. During the period of study, the average income of the HYS, i.e., HR, MH, PB, KA, KL, TN, GJ, and AP, is more than the country's PC income, and vice-versa for the case of LYS, i.e., BR, UP, MP, OR, WB, and RJ.
5. Total here refers to the aggregate of revenue expenditure and capital outlay accounts.

APPENDIX

- **APPENDIX B: Cross-Section Dependency (CSD) Test Results**

Variable	High-Income States		Low-Income States	
	CD Stat.	p-value	CD Stat.	p-value
lnNSDP	29.27*	0.000	20.99*	0.000
lnTSSE	28.27*	0.000	20.51*	0.000
lnTESE	22.76*	0.000	18.30*	0.000
lnTGSE	26.49*	0.000	20.11*	0.000
lnRSSE	28.66*	0.000	20.46*	0.000
lnCSSE	21.78*	0.000	18.51*	0.000
lnRESE	21.98*	0.000	18.63*	0.000
lnCESE	17.70*	0.000	15.67*	0.000
lnRGSE	26.32*	0.000	20.10*	0.000
lnCGSE	18.92*	0.000	12.47*	0.000

Source: Researcher's calculation based on RBI data.
*Note: Asterisk, * represents the 1 % significance level.*

- ***APPENDIX A: Summary Statistics***

Variables	lnNSDP	lnTSSE	lnTESE	lnTGSE	lnRSSE	lnCSSE	lnRESE	lnCESE	lnRGSE	lnCGSE
					High-Income States					
Mean	11.078	8.151	8.094	8.126	8.063	5.038	7.662	7.053	8.109	5.031
Median	11.014	8.029	8.049	8.168	7.934	5.152	7.665	7.037	8.144	4.975
SD.	0.501	0.542	0.494	0.57	0.534	1.124	0.478	0.7	0.571	0.26
Min	10.077	7.213	7.07	6.877	7.184	1.119	6.598	0	6.849	4.734
Max	12.047	9.164	9.622	9.292	9.102	7.009	8.91	8.406	9.289	6.774
Skewness	0.121	0.251	0.223	-0.254	0.2844	-0.272	0.189	-4.015	-0.242	2.046
Kurtosis	1.915	1.796	2.563	2.321	1.823	2.369	2.289	42.477	2.329	12.224
Observation	248	248	248	248	248	248	248	248	248	248
					Low-Income States					
Mean	10.316	7.688	7.536	7.617	7.604	4.81	7.038	6.803	7.598	4.93
Median	10.261	7.6	7.428	7.674	7.533	4.948	6.904	6.763	7.609	4.871
SD.	0.495	0.55	0.566	0.443	0.53	1.074	0.577	0.479	0.442	0.443
Min	9.137	6.786	6.342	6.701	6.756	2.38	5.881	5.887	6.694	0
Max	11.246	9.01	9.155	8.526	8.88	6.768	8.498	8.153	8.515	5.906
Skewness	-0.119	0.361	0.563	-0.021	0.401	-0.038	0.559	0.529	0.004	-7.145
Kurtosis	2.553	2.18	2.891	1.985	2.2	1.842	2.77	2.798	1.99	84.058
Observation	186	186	186	186	186	186	186	186	186	186

Source: Researcher's calculation based on RBI data.

- **APPENDIX C: Slope Heterogeneity (SH) Test Results**

		High-Income States	Low-Income States
Models	Statistic	Value	Value
I	Delta_tilda	6.630*	6.650*
	Adjusted Delta_tilda	7.104*	7.126*
II	Delta_tilda	12.987*	4.856*
	Adjusted Delta_tilda	13.915*	5.203*
III	Delta_tilda	9.845*	15.428*
	Adjusted Delta_tilda	10.549*	16.532*
IV	Delta_tilda	7.780*	6.452*
	Adjusted Delta_tilda	8.495*	7.045*

Source: Researcher's calculation based on RBI data.
*Notes: * represents significance level at the 1 % level. Delta_tilda and Adjusted Delta_tilda represent the 'simple' and 'mean-variance bias adjusted' slope homogeneity tests, respectively.*

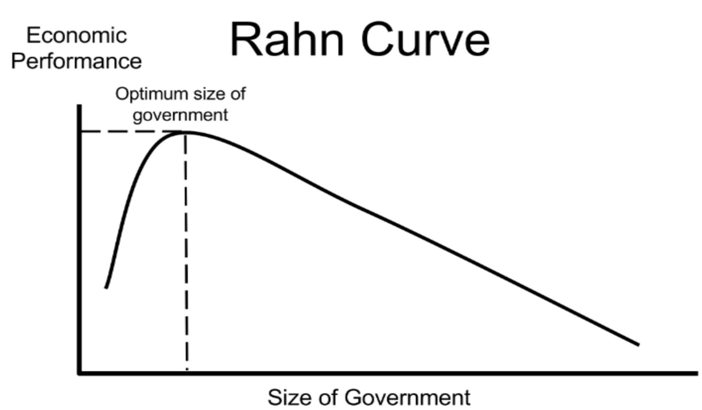
- **APPENDIX D: Panel Unit Root / Integration Test Results**

Variables	High-Income States		Low-Income States	
	I (0)	I (1)	I (0)	I (1)
Cross-Sectionally Augmented Dickey-Fuller				
lnNSDP	(-)2.862**	--	(-)2.600	(-)4.082**
lnTSSE	(-)2.621	(-)4.422**	(-)1.833	(-)4.018**
lnTESE	(-)2.836	(-)4.988**	(-)2.486	(-)4.261**
lnTGSE	(-)2.826	(-)3.572**	(-)2.903	(-)4.662**
lnRSSE	(-)2.336	(-)4.145**	(-)2.065	(-)4.333**
lnCSSE	(-)2.489	(-)4.146**	(-)3.455	(-)4.201**
lnRESE	(-)2.960**	--	(-)2.420	(-)4.158**
lnCESE	(-)2.423	(-)4.057**	(-)2.602	(-)4.361**
lnRGSE	(-)2.709	(-)3.491**	(-)2.787	(-)4.718**
lnCGSE	(-)2.249	(-)3.672**	(-)2.488	(-)2.878**
Cross-Sectionally Augmented IPS				
lnNSDP	(-)2.886**	--	(-)3.303**	--
lnTSSE	(-)2.852**	--	(-)2.722	(-)6.206**
lnTESE	(-)3.836**	--	(-)3.319**	--
lnTGSE	(-)2.745	(-)5.308**	(-)2.880**	--
lnRSSE	(-)2.542	(-)5.494**	(-)2.968**	--
lnCSSE	(-)2.843**	--	(-)2.876**	--
lnRESE	(-)3.635**	--	(-)3.237**	--
lnCESE	(-)2.697	(-)5.296**	(-)3.252	--
lnRGSE	(-)2.697	(-)5.296**	(-)2.913**	--
lnCGSE	(-)2.697	(-)5.068**	(-)2.479	(-)4.849**

Source: Researcher's calculation based on RBI data.

*Notes: ** represents 5 % significance level. The integration order I (0) or I (1) shows the level or 1st difference. The results are noted at lag one at Schwartz Bayesian Information Criterion (SBIC) with constant and trend deterministic.*

- ***APPENDIX E: Rahn Curve***



Source: Pepple and Ekpete, 2021

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