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Government expenditure and economic growth in North Eastern Region of India: Toda - Yamamoto causality approach

Sorokhaibam Aguraj Singh *
Assistant Professor, Department of Economics, Imphal College, Imphal, Manipur

Sonching Panmei
M.Ed student D.M College of Teacher Education, Manipur

*Corresponding Author Email: agurajs@gmail.com

Abstract: *This study examines the impact of government expenditure on economic growth in the North Eastern Region of India, addressing whether government spending causes economic growth or vice versa. Using the Toda-Yamamoto causality approach, the analysis reveals that the Wagner hypothesis holds in one state, while the neutrality hypothesis is supported in the other states. These findings suggest that policymakers should consider not only the amount of government spending but also the efficiency of public expenditure when formulating fiscal policies.*

Keywords: Granger causality, public expenditure, economic growth, NorthEast India

INTRODUCTION

The debate on the association between public spending and economic growth continues in the study of public finance. It has focused on public spending and national income for years, mainly because public spending has risen steadily in nearly every global nation (Marica & Piras, 2018). Understanding the link between public spending and Gross Domestic Product (GDP) is crucial for long-term public finance and short to medium term policy issues (Arpaia & Turrini, 2007).

The expenditure of the Indian government is 16.08 per cent of GDP in 2021-22. At the sub-national level, expenditure differs according to the state's resource base and absorption capacity. Some states have a restricted resource base due to their inherent qualities, making it difficult to mobilise the essential resources for development. In recognition of these issues, 12 states were recognised as 'Special Category States' and granted preferential status, which includes central aid and tax breaks. Out of which, Assam, Manipur, Meghalaya, Arunachal Pradesh, Mizoram, Tripura, and Sikkim are known as India's North Eastern Region States, hereafter NER states.

A brief account of NER states government spending

Table 1 shows the average spending of NER states as a proportion of the Gross State Domestic Product (GSDP) for selected years. The Indian government expenditure as a portion of GDP has decreased from 15.63% in (1991/92 to 1995/96) to 13.73% in (2016/17 to 2021/22). However, if the individual year 2021/22 is considered, the expenditure increases to 16.08%. For the NER states, on average, spend more than 30% except Assam. It can be inferred that spending in NER states is above the national average, which indicates that the government has a pivotal part in the economy. Given the spending level, the connection between spending and growth for the NER states warrants examination.

Table 1: Average total expenditure as % of GSDP for selected years

	1991/92 to 1995/96	2006/07 to 2010/11	2011/12 to 2015/16	2016/17 to 2020/21	2021/22
AP	68.35	67.72	55.74	63.14	83.20
AS	23.33	22.55	21.02	23.19	40.19
MN	55.21	59.52	48.76	44.95	72.17
MG	42.81	29.55	30.40	36.00	43.07
MZ	82.17	66.29	54.68	44.34	46.93
NL	71.55	43.78	47.65	47.24	48.31
SK	-	82.56	31.13	23.63	26.79
TR	49.11	32.96	32.89	29.09	38.05
India^	15.63	14.95	13.87	13.73	16.08

Note: ^ as a per cent of GDP Source: Author's calculation

With this background, this paper is organized as follows: review of literature offers a concise overview of theoretical and empirical key studies related to expenditure and growth relationship. The methodology section elaborates the econometric techniques utilised in the analysis. The results section delves into the findings. The discussion section discusses the findings, connecting them to broader policy considerations. Finally, the conclusion section wraps up with the main insights of the study.

REVIEW OF LITERATURE

According to Ayad et al. (2020, p. 316), theoretically, four likelihood causality emerge among public spending and economic growth "1-Wagner's law hypotheses: unidirectional causal relationship running from economic growth to government expenditure; 2-Keynesian hypotheses: unidirectional causal relationship running from government expenditure to economic growth; 3- Feedback hypotheses: bi-directional causal relationship between government expenditure and economic growth; 4- Neutrality hypotheses: no causal relationship between government expenditure and economic growth."

Numerous empirical works have been conducted globally to study the association between income and expenditure. Narayan et al. (2008), with Granger causality, showed existence of Wagner Law on Fiji islands. Menyah and Rufael (2013) studied with data from 1950-2007 the association between government spending and growth of an economy with ARDL technique and found a long-run association. Further, the Granger causality revealed the presence of the Wanger hypothesis, i.e., a unidirectional causality runs from the growth of the economy to spending by the government. However, Ebaid and Bahari (2019) found the Keynesian hypothesis in Kuwait's economy. Efthalitsidou et al. (2021) also analyse spending on education, health and defence and its effect on the Greece economic growth. Johanson co-integration test supported the presence of long-run connection. Also, the causality test revealed that causality runs from GDP to government spending. Popescu and Diaconu (2021) found the existence of bi-directional causality among GDP and government spending in Romania. However, Johansen's co-integration test method confirmed the non-existence of co-integration between the variables in Romania from 1995 to 2018. Poku et al. (2022) explored the effect of spending by government on GDP growth from 1970 to 2016. The findings show that expenditure significantly and positively influences the GDP annual growth.

The negative relationship; Ghosh and Gregoriou (2008) investigations also revealed a negative connection among government spending and GDP growth. Cenc (2022) investigated the effect of government spending on the growth of economy for 19 European countries with panel data from 1995 to 2020 with OLS and found a negative relationship. It was found that when spending as percent of GDP rises by 1%, the economic growth reduces by about 0.51%. Koceveska (2023) from North Macedonia adopted the ARDL model from 1991 to 2020 and found that public spending does not contribute to the growth of an economy.

The literature mentioned above highlights the lack of agreement among researchers concerning the connection between expenditure and economic growth. This raises the need to reassess the relationship, particularly in NER states where expenditure is exceptionally high and has been overlooked in the studies. The study is an earnest attempt to fill this void in the literature.

METHODOLOGY

Data Sources and Variables:

The relationship between income and expenditure is investigated using quantitative annual data of NER states. Each state GSDP is a proxy for income, and government expenditure is the sum of capital and revenue account expenditure in the state budget. The study uses different sample periods for each state due to discrepancies in the available data. For Arunachal Pradesh, Assam, Manipur, Meghalaya, Tripura 1991/92-2021/22, for Mizoram 1999/00-2021/22, for Nagaland 1993/94-2021/22, and for Sikkim 2009/10-2021/22. The GSDP data are extracted from Central Statistical Organizations Publications, Government of India (GoI) website. For government expenditure, it was obtained from the RBI publication "State Finances- A Study of Budgets" various issues. All the variables are converted into natural logarithmic forms to avoid serial correlations. The GSDP and total expenditure are at constant 2011-12 prices deflated with the GSDP deflator. It is deflated because current prices may create an illusion that the expenditure increases over time. The study adopted real GSDP as a proxy for growth of an economy in line with the study of Narayan et al. 2008). The econometric analysis was done using the EViews 12 student version software.

The seminal paper of Peacock-Wiseman version of Wagner is as follows

$$G = f(Y) \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (1)$$

Where GG= real government spending, and $Y = Y =$ real output. This study also adopts this model to examine the relationship.

Econometric Method

To avoid spurious regression, the initial step for the empirical study is to examine the unit root of the variables. To do so, the Augmented Dickey fuller (ADF) test. The ADF test builds upon the basic Dickey-Fuller test by adding another lagged term of the dependent variable. This enhancement captures higher-order auto-regressive processes and effectively addresses auto-correlation in the residuals. The null hypothesis is non-stationary and the alternative is stationary. Toda and Yamamoto (1995) causality test requires determining the order of integration of the variables so unit root test is applied.

In a bivariate framework, the first variable is considered to Granger cause the second if the inclusion of its past values enhances the predictive accuracy of the second variable. The advantage of this method over other alternatives due to its effective performance with both large and small sample sizes (Akinboade & Braimoh, 2010). However, the power of the test decreases if the variables are blends of I(0) and I(1). To address this issue, Toda and Yamamoto (1995) hereafter T-Y modifies the Granger causality test, which utilises a modified Wald (MWALD) test within an augmented vector autoregressive (VAR) framework. Steps to perform the Y-T causality test:

First, utilise unit root tests (such as ADF) to establish order of maximum integration (d_{max}). Second, ascertain the optimum lag length (k) by using information criterion such as Hannan-Quinn Criterion (HQ), Log Likelihood (LogL), Schwarz Criterion (SC), and Akaike Information Criterion (AIC). Third, conduct the Block Exogeneity Wald test on the estimated VAR model of order $(k + d_{max})^{th}$ to determine the direction of causality. If the test discards the null hypothesis that the lagged coefficients are jointly zero, it indicates sign of Granger causality between the variables.

The model is as follows:

$$Govexp_t = \alpha_0 + \sum_{i=1}^{k} \alpha_{1i} GovExp_{t-i} + \sum_{j=k+1}^{d_{max}} \alpha_{2j} GovExp_{t-j} + \sum_{i=1}^{k} \delta_{1i} GSDP_{t-i} + \sum_{j=k+1}^{d_{max}} \delta_{2j} GSDP_{t-j} + \lambda_{1t} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (2)$$

$$Govexp_t = \alpha_0 + \sum_{i=1}^{k} \alpha_{1i} GovExp_{t-i} + \sum_{j=k+1}^{d_{max}} \alpha_{2j} GovExp_{t-j} + \sum_{i=1}^{k} \delta_{1i} GSDP_{t-i} + \sum_{j=k+1}^{d_{max}} \delta_{2j} GSDP_{t-j} + \lambda_{1t} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (2)$$

$$GSDDP_t = \gamma_0 + \sum_{i=1}^{k} \gamma_{1i} GSDP_{t-i} + \sum_{j=k+1}^{d_{max}} \gamma_{2j} GSDP_{t-j} + \sum_{i=1}^{k} \delta_{1i} GovExp_{t-i} + \sum_{j=k+1}^{d_{max}} \delta_{2j} GovExp_{t-j} + v_{1t} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (3)$$

$$GSDDP_t = \gamma_0 + \sum_{i=1}^{k} \gamma_{1i} GSDP_{t-i} + \sum_{j=k+1}^{d_{max}} \gamma_{2j} GSDP_{t-j} + \sum_{i=1}^{k} \delta_{1i} GovExp_{t-i} + \sum_{j=k+1}^{d_{max}} \delta_{2j} GovExp_{t-j} + v_{1t} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (3)$$

Granger causality from $GSDP_t$ *to* $GovExp$ $H_0: \delta_{1i} = 0 \forall i$ $GSDP_t$ *to* $GovExp$ $H_0: \delta_{1i} = 0 \forall i$ for eqn 2 and Granger causality from $GovExp$ *to* $GSDP$ $H_0: \phi_{1i} = 0 \forall i$ $GovExp$ *to* $GSDP$ $H_0: \phi_{1i} = 0 \forall i$ for eqn 3.

This study applied the T-Y test as the time period is short, and is suitable for the variables that are stationary at I(0) and I(1). Also, the T-Y method simply requires VAR to be at the level values, and it does not result in the information loss issue that we observe in the difference procedure (Bilgehan, 2018).

RESULTS

Table 2 systematically summarises the results of the ADF test. The analysis revealed a diverse array of integration orders among the variables under consideration, with some exhibiting I(0), i.e., stationary at the level, and others displaying I(1), i.e. stationary at the first difference.

Table 2: Results of the ADF unit root test for NER states

States	Series	ADF test on level data	ADF test on first difference data	Conclusion
AP	LnGSDP	0.153	-4.746***	I(1)
	LnGE	0.026	-7.875***	I(1)
AS	LnGSDP	2.776	-5.954***	I(1)
	LnGE	2.766	-6.060***	I(1)
MN	LnGSDP	-0.078	-4.158**	I(1)
	LnGE	0.617	-7.965***	I(1)
MG	LnGSDP	-1.024	-5.697***	I(1)
	LnGE	1.284	-8.068***	I(1)
MZ	LnGSDP	-0.14	-3.888**	I(1)
	LnGE	-0.376	-7.978***	I(1)
NL	LnGSDP	-0.911	-4.931***	I(1)
	LnGE	-0.182	-7.361***	I(1)
SK	LnGSDP	-0.966	-3.171**	I(1)
	LnGE	-1.127	-5.121**	I(1)
TR	LnGSDP	-0.385	-6.407***	I(1)
	LnGE	1.291	-6.891***	I(1)

Note: *** at 1%, ** 5%, and * at 10% statistically significant. Automatic lag length selection based on AIC with maxlag=2.
Source: Author's calculation

The optimal lag (k) selection for each state was determined based on criteria such as LogL, AIC, and SC, which is reported in Table 3. Using AIC, the lag length is 1 for states such as Mizoram Nagaland, Assam, Arunachal Pradesh, Sikkim and Tripura. For Manipur and Meghalaya, it is 2.

Table 3: Selecting the VAR lag order criteria

States	Lag	LR	AIC	SC
AP	0	NA	0.254	0.350
	1	109.739*	-4.022*	-3.734
	2	5.456	-3.974	-3.494
AS	0	NA	0.002	-0.459
	1	99.473*	4.631*	-4.307*
	2	0.548	0.000	-4.036
MN	0	NA	0.003	-0.005
	1	103.590	0.000	-4.025
	2	10.111*	5.240*	-4.188*
	3	4.713	0.000	-4.128
MG	0	NA	0.003	-0.102
	1	132.765	0.000	-5.338
	2	12.900*	1.245*	-5.627*
	3	1.334	0.000	-5.398
MZ	0	NA	0.002	-0.605
	1	81.433*	2.980*	-4.748*
	2	4.180	0.000	-4.629
NL	0	NA	0.003	-0.281
	1	122.003*	1.750*	-5.277
	2	1.429	0.000	-5.038
SK	0	NA	0.001	-1.773
	1	33.788*	1.815*	-5.269*
	2	2.680	0.000	-4.989
TR	0	NA	0.0029	-0.1552
	1	137.524*	1.280*	-5.589*
	2	6.2708	0.0000	-5.5778

Note: The lag order selected by the criterion is designated by *, and each test is conducted at the 5% level.
Source: Author's calculation

Table 4: Results of the T- Y causality test for the bivariate VAR model

		Lag(k)	$(k+d_{max})$	Chi-sq	df
AP	H_0: LNGSDP≠ > LNTE	1	1+1=2	0.000	1
	H_0: LNTE ≠ >LNGSDP			3.061*	1
AS	H_0: LNGSDP≠ > LNTE	1	1+1=2	4.95**	1
	H_0: LNTE ≠ >LNGSDP			0.853	1
MN	H_0: LNGSDP≠ > LNTE	2	2+1=3	3.603	2
	H_0: LNTE ≠ >LNGSDP			2.017	2
MG	H_0: LNGSDP≠ > LNTE	2	2+1=3	3.352	2
	H_0: LNTE ≠ >LNGSDP			3.381	2
MZ	H_0: LNGSDP≠ > LNTE	1	1+1=2	0.675	1
	H_0: LNTE ≠ >LNGSDP			0.279	1
NL	H_0: LNGSDP≠ > LNTE	1	1+1=2	1.333	1
	H_0: LNTE ≠ >LNGSDP			0.335	1
SK	H_0: LNGSDP≠ > LNTE	1	1+1=2	1.188	1
	H_0: LNTE ≠ >LNGSDP			0.061	1
TR	H_0: LNGSDP≠ > LNTE	1	1+1=2	0.437	1
	H_0: LNTE ≠ >LNGSDP			0.003	1

Note: ** at 5%, and * at 10% statistical significance. Source: Author's calculation

T-Y causality test reveals a varied directional relationship between government expenditure and GSDP. Only in Assam GSDP significantly granger causes government expenditure at a 5% significance level. This uni-directional causality support Wagner's Law. Meanwhile, in Mizoram Manipur, Sikkim, Arunachal Pradesh, Nagaland, Meghalaya, and Tripura, no causality is observed in either direction, supporting the neutrality hypothesis

DISCUSSION

The findings of the T-Y causality test highlight varied fiscal economic relationships across NER states, offering important insights into regional dynamics. The findings of Assam align with existing literature on growthled expenditure and reflect its relatively advanced economic structure and effective fiscal policies. This finding is similar to Rani and Kumar (2020) of India after post-reform. In contrast, the absence in the remaining states coincides with the result of Chaudhuri and Sengupta (2009) for Tamilnadu. The findings have broader implications for fiscal policy. In Assam, the focus should be on sustaining the growth-expenditure nexus through targeted investments in infrastructure and social sectors. For other states, improving public spending efficiency, diversifying economic activities, and enhancing governance are critical to fostering growth. Future research could explore disaggregating the total expenditure to provide a more comprehensive understanding of state-level dynamics.

CONCLUSION

It is crucial to examine the income and expenditure relationship for the NER states so that the fiscal health of these states can be managed appropriately and timely. This paper empirically examined the NER states' linkages between income and expenditure after the post-reform period using the ADF unit root and Y-T causality tests. The varying causal relationships across states reflect the complex interplay between economic development and public expenditure patterns. The findings in Assam, where economic growth leads to increased expenditure, resonate with Wagner's Law. The lack of causality in Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura highlights a potentially different dynamic where other factors, such as governance, institutional quality, or external factors, might independently drive economic growth and expenditure. While expanding government expenditure is often viewed as a tool for stimulating economic activity, the absence of a causal relationship in this direction could imply that such policies may not generate immediate economic returns, at least in the short run. This observation calls for deeper analysis into the underlying drivers of public expenditure and economic outcomes in these states, and policymakers should consider efficiency in determining expenditure allocations.

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