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Threshold Impacts of Public Expenditure on Economic Growth: Insights from India Utilizing Panel Threshold Regression Model

Neelam Sharma*

Jaypee University of Information Technology, India

Sakshi Khanna

University College of Business Studies, Himachal Pradesh University, India

Amit Srivastava

Jaypee University of Information Technology, India

Abstract

This research examines the impact of public expenditure dynamics on economic growth in India and its six distinct regions (North-Eastern, Northern, Western, Southern, Eastern, and Central) using Hansen's panel threshold regression model. Spanning from 1999–2000 to 2018–19, the analysis reveals significant inter-regional variations in the relationship between public expenditure and economic growth. The Northern, Western, and North-Eastern regions exhibit a singular threshold impact, indicating that exceeding this threshold level may not positively influence economic growth and could lead to fiscal imbalances. In contrast, the Central, Eastern, and Southern regions illustrate no threshold effect. Furthermore, the study identifies that the optimal expenditure threshold is higher for the North-eastern region (81.9%) compared to the Northern (60.5%) and Western regions (50.7%), reflecting higher expenditure requirements. Conversely, when considering India as a whole, no threshold effect is observed, indicating a consistent impact across all regions. The findings underscore the importance of policymakers' attention to optimal expenditure, crucial for addressing long-term budgetary imbalances and fostering inclusive growth.

Keywords: public expenditure; threshold regression model; economic growth; fiscal policy; fiscal imbalances
JEL Classification: C24; H50; O23; O40

* **Corresponding Author**, Address: Waknaghat, Himachal Pradesh 173234, India. Email: neelam.sml@gmail.com

1. Introduction

A robust nation represents a blend of advantages, necessitating the simultaneous fulfillment of diplomatic international boundaries and the provision of essential social infrastructure to its citizens, such as health, housing, and education. However, in the current global landscape, the paramount focus lies on fostering strong and inclusive economic growth across nations. Emerging as well as developed nations share the common goal of attaining targeted levels of economic growth (Miller & Tsoukis, 2001). Now, in order to bolster economic growth in countries, an essential priority entails enhancing fiscal policy instruments, where public expenditure emerges as a pivotal strategic tool. Also, as per Keynes' hypothesis, public spending leads to increased economic growth (Arvin et al., 2021). Further, it is seen that public expenditure promotes strong and sustainable growth in two ways: first, by financing various programs and projects, the government actively contributes to delivering improved services to its citizens. Second, the regulations and policies made and executed by the government impact the private sector as well, aiming to stimulate economic growth through fiscal expansion, increasing private sector expenditure, and resulting in growth via the multiplier effect (Ortiz-Ospina & Roser, 2023). But as it's said that excess of everything is bad, so is the case here also. Excessive public spending can hinder economic growth by crowding out private investment through higher interest rates. This has the potential to result in inflation and a misallocation of resources when projects are politically motivated. High taxes to support spending may reduce economic activities, while persistent deficit financing can result in burdensome public debt, limiting the government's crisis response capabilities. Balancing necessary public spending with fiscal discipline is vital for sustainable economic development (Ahuja & Pandit, 2020). Accordingly, the effectiveness and efficiency of public expenditure can be directly gauged through the attainment of economic growth in the economy (Rajkumar & Swaroop, 2008; Sharma et al., 2022; Vinturis, 2023). Thus, the purpose is to assess the efficiency of public expenditure intended for ensuring growth levels.

Now, public expenditure comprises two key components: capital expenditure and revenue expenditure. Capital expenditure, a vital driver of long-term economic development, fosters societal advancement by promoting innovation and heightened productivity. This involves investments in infrastructure projects, technology, and public facilities. In contrast, revenue expenditure addresses regular expenses, such as government employee remuneration and service maintenance; lacking the creation of enduring assets. While revenue expenses are essential for sustainability, capital expenditures possess transformative potential, catalyzing revolutionary changes for higher productivity, job creation, and a more competitive economy. Prioritizing capital spending is essential for emerging economies seeking to break free from underdevelopment, representing an investment in future prosperity. In this context, the ratio of capital expenditure to total expenditure serves as an analogy for public expenditure, emphasizing the importance of prioritizing long-term investments for sustained development and prosperity (Sarma, 2018).

Furthermore, it has been noted that public expenditure influences economic growth in three ways: numerous studies on developing countries consistently reveal a positive effect of public expenditure on growth

(Asghari & Heidari, 2016); conversely, for developed nations, the effect tends to be negative (Schmidt & Wigerstedt, 2019). Another set of studies says that public spending is advantageous up to a specific threshold, above which its influence turns unfavorable to economic growth (Mishra & Mohanti, 2021). This is also shown in the BARS curve (named after Barro (1990), Armey (1995), Scully (1995), and Rahn & Fox (1996)), where a reversed "U-shaped" relationship exists among government spending and economic advancement.

Focusing specifically on India, it is noteworthy that the country has maintained steady growth and ranks among the fastest-rising economies globally, continually striving to achieve a sustained period of economic growth, whereas fiscal imbalances remain high (Ghosh, 2022). The strong pressure of spending to achieve targeted growth could be the reason for large economic imbalances. Nonetheless, the Fiscal Responsibility and Budget Management Act was enacted by the Parliament with a focus on achieving economic progress through fiscal balances, ensuring the sustainability of the economy. The legislation emphasizes the responsibility of governments to prudently manage fiscal balances, recognizing that these funds constitute the hard-earned money of the general public (Maurya, 2023).

Accordingly, the current study aims to investigate firstly, whether an asymmetric non-linear relationship exists between public expenditure and economic growth in India or not. Secondly, if such a relationship exists, then the study seeks to establish the optimal level (threshold) of public expenditure. For the same, Hansen's (1999) advanced panel threshold regression model is used. Further, to delve into a more granular perspective, the study takes into account six distinct regions of India, namely, Northern, Western, Southern, Central, Eastern, and Northeast. It is assumed that the optimal level of public expenditure may vary among these regions based on their economic factors, density, employment, topography, government policies, socio-economic conditions, and other factors. Thus, both these objectives are also examined across these six Indian regions.

The remaining portion of the paper is organized as follows. The relationship between government expenditures and economic growth is discussed in section 2 through a thorough review of the literature. The variables utilized for the study, model specifications, and research techniques are all described in Section 3. The study's discussion and empirical results are analyzed in Sections 4 and 5. Lastly, Section 6 summarizes and addresses the consequences for policy and its potential future applications.

2. Literature Review

There is ongoing debate on the impact of government spending on economic growth, with differences attributed to various factors such as fiscal policy reforms and research methodologies (Gwartney et al., 1998). Ancient economists like Kautilya, Plato, and Aristotle recognized the significance of public finances in national growth. Kautilya's works, Arthashastra and Neethishatra, dating back approximately 2500 years, emphasize governance, including economics, military strategy, and diplomacy. Kautilya advocated for using income to support social infrastructure, prioritizing the welfare of the people, who are vital for a nation's strength (Kennedy, 2012; Sarma, 2018).

Classical and modern economists supported a robust public sector for national growth, as posited by Wagner's Law, linking increased public expenditure with economic growth. However, measuring these variables remains a contemporary challenge (Brennan & Buchanan, 1980; Olson, 1993; Buchanan & Musgrave, 1999; Kochhar et al., 2006; Rao & Chatterjee, 2018).

Public spending has been integral since ancient civilizations (Kennedy, 2012), but until the 19th century, laissez-faire principles limited government interference. This changed with J.M. Keynes's "The General Theory of Employment, Interest, and Money" in 1929, advocating for government intervention during economic crises. Keynesian economics helped mitigate the Great Depression (Keynes, 1936). Post-WWII, devastated economies invested in public spending for recovery and long-term growth (Hsieh & Lai, 1994; Pike et al., 2017).

Public spending is crucial for economic growth, with government expenditure positively correlated with success and growth (Rao, 1964; Naggar, 1977; Ram, 1986). Feder's (1983) study using the Granger causality technique revealed a direct association between public spending and economic growth. Ram (1986) confirmed this finding across 115 nations. Barro (1990) introduced an endogenous growth model, finding that while government spending is significant for long-term growth paths, higher spending often correlates with slower growth rates, especially when funded by distortionary taxes. Reductions in spending can lead to faster growth rates by reducing tax burdens and promoting private sector investment, highlighting the importance of wise government spending policies and budgetary restraint (Barro, 1990).

Hsieh and Lai (1994) found that the relationship between public spending and growth varies over time and among industrialized economies, with no consistent positive link between government expenditure on infrastructure and GDP. Kneller et al. (1999) investigated fiscal policy's impact on economic growth across OECD nations, finding that while fiscal policy influences growth, the specific measures used determine the extent of impact. Increases in government spending, especially when financed by unfair taxation, tend to negatively affect growth, whereas lower government spending relative to GDP is associated with faster growth rates, particularly in initially high-spending nations. They also observed asymmetric effects of fiscal policy factors like taxation and government consumption on growth, underscoring the need for tailored fiscal policy adjustments based on each nation's economic circumstances.

Government capital investment has significant positive effects, particularly in emerging nations (Gunalp & Gur, 2002). Studies by Bose et al. (2007) and Baldacci et al. (2008) affirm that government expenditures contribute to economic growth in emerging economies. Cooray (2009) highlights the impact of public spending on economic growth. Dogan and Tang (2006) identified a causal relationship between government spending and GDP in Southeast Asia, particularly in the Philippines, although not consistently across other nations like Indonesia, Malaysia, Singapore, and Thailand. Ghosh and Gregoriou (2008) and Chimobi (2009) support the positive association between government spending and economic growth in 15 emerging economies. Acemoglu et al. (2001) and Yamaguchi and Kinugasa (2014) found mixed but generally

favorable results regarding the long-term economic growth effects of public spending, particularly on capital. Mohapatra et al. (2016) concluded that public spending enhanced India's long-term economic well-being.

Empirical research on public expenditure and economic growth yields conflicting outcomes. Favorable associations were found by Feder (1983), Ram (1986), Ghali (1998), Yasin (2000), Loizides and Vamvoukas (2005), Dogan and Tang (2006), Bose et al. (2007), Pradhan (2007), and Romero-Avila and Strauch (2007). Conversely, negative correlations were discovered by Devarajan et al. (1996), Kneller et al. (1999), Dar and Khalkhali (2002), Guseh and Oritsejafor (2007), Nurudeen and Usman (2010), and Sáez et al. (2017). Meanwhile, Afxentiou and Serletis (1996), Bagdigen and Cetintas (2003), Afzal and Abbas (2010), Ray and Ray (2012), and Ayad et al. (2020) found no relationship between government public spending and economic growth.

Research suggests a "U-shaped" curve relationship between government spending and economic progress, known as the BARS curve (Barro, 1990; Armey, 1995; Scully, 1995; Rahn & Fox, 1996). Optimal public spending is beneficial up to a certain threshold but becomes detrimental beyond that point. This concept has been empirically studied by various researchers (Karras, 1997; Altunc & Aydn, 2013; Chen & Lee, 2005). The Armey paradigm highlights the statistically significant inverted "U-shaped" relationship between public spending and economic wellness, with optimal spending at threshold values (Pevcin, 2004; Mavrov, 2007; Vaziri et al., 2011; Coayla, 2021; Asimakopoulos & Karavias, 2016).

As far as the authors are aware, no prior study has investigated the nonlinear link between public expenditure and economic growth in India and its regions. To close the gap, we analyze threshold effects in public spending and economic development. Our study differs from others since Indian regions were studied independently using Hansen's 1999 dynamic panel threshold regression model.

3. Research Methodology

The study examines the impact of public expenditure dynamics on economic growth using the panel threshold regression model. The panel threshold model is chosen because the OLS regression model is equal across all observations in a sample, and this model indicates that individual observations can be sorted into different classes based on a continuous observable variable (public expenditure) in our example) (Khanna et al., 2016). This model is used when the sample-splitting value is uncertain (Hansen, 1999; Hansen, 2000). The above methodology quantifies rather than assumes the threshold level. This model analyses panel data by randomly varying the coefficient across time and across cross-sectional units (Hsiao, 2003; Khanna et al., 2016). The analysis is carried out using the open-source software-gretl version 1.10.1.

3.1 Variable Used

There are three sets of variables in this research study: the dependent variable, the independent variable, and the control variable. The dependent variable is economic growth and for this study, Net State Domestic Product Per Capita (NSDP) is used as a proxy. Though there are many aspects of economic growth in national income accounts, however, NSDP stands as the most commonly employed metric for assessing

economic growth at the state level (Shand & Bhide 2000; Raichoudhury, 2020; Tiwari et al., 2021; Sharma et al., 2022). Following by the threshold variable, which serves as the primary independent variable utilized to explore the asymmetric threshold effect of public expenditure (specifically, the ratio of capital expenditure to total expenditure) on economic growth. Therefore, public expenditure is considered the threshold variable (Chindengwike & Tyagi, 2022).

Moreover, based on the existing literature, it is observed that the investment component i.e. Gross Fixed Capital Formation (GFCF) also has an impact on the economic growth of the country. However, here authors are mainly interested in exploring the effects of public expenditure on economic growth; therefore, in order to improve the fitness of the model, gross fixed capital formation is considered as the control variable (Peprah et al., 2019; Onifade et al., 2020; Neog & Gaur, 2020). Table 1 displays the three variables that were utilized, alongside the data sources and computation for each.

Table 1: Variables, computation and data sources

Variable Name	Computation	Data Sources
Public Expenditure (PE)	The ratio of capital expenditure to total expenditure, where total expenditure is the sum of capital expenditure and revenue expenditure.	Public finance statistics for Indian states, as documented in the Different volumes published by the Reserve Bank of India (RBI).
Economic Growth (EG)	Net state domestic product (NSDP) per capita	Ministry of Statistics and program implementation (MOSPI).
Capital Formation (CF)	Gross Fixed Capital Formation (GFCF).	Reserve Bank of India (RBI).

Source: Authors' compilation

Note: Public Expenditure (PE) is a nomenclature used in place of Ratio of Capital Expenditure to Total expenditure.

3.2 Sample Used

This analysis uses Indian state data from 1999-2000 to 2018-2019. Further, these states have been joined together to form a panel, called pan India, and we've classified them into six primary areas according to the State Reorganization Act, 1956 given below:

1. North-Eastern (Assam, Meghalaya, Nagaland, Tripura and Manipur)
2. Northern (Jammu and Kashmir, Himachal Pradesh, Punjab, Haryana and Rajasthan)
3. Western (Maharashtra, Goa and Gujarat)
4. Southern (Karnataka, Kerala, Tamil Nadu and Andhra Pradesh)
5. Eastern (Bihar, Jharkhand, Orissa and West Bengal)
6. Central (Uttar Pradesh, Uttarakhand, Chhattisgarh and Madhya Pradesh)

We found that data for the UTs and four states, Telangana, Mizoram, Arunachal Pradesh, and Sikkim, were missing from 1999-2000 to 2018-2019, thus we dropped them.

3.3 Objective

The study pursues two primary objectives: firstly, to examine the presence of an asymmetric non-linear relationship between public expenditure and economic growth across India, and secondly, if such a relationship is identified, to ascertain the optimal threshold level of expenditure. This involves identifying the value from where the increased expenditure may cease to positively impact economic growth and could potentially contribute to fiscal imbalances. The second is to test the same for six different Indian regions.

3.4 Model Considered

To capture the response on economic growth (EG) via public expenditure (PE), the advance panel threshold regression model developed by Hansen (1999) is applied:

$$\boldsymbol{y_{it} = \mu_i \beta_1 PE_{it} X_{it}(PE_{it} < PE^*) + \beta_2 PE_{it} X_{it}(PE_{it} > PE^*) + \theta I_{it} + e_{it}} \quad (1)$$

The estimation of the above model is also considred in the research work of Greenidge et al., 2012 & Khanna et al., 2016:

$$\boldsymbol{y_{it} = \mu_i \beta_1 (1 - X_{it})(PE_{it} - PE^*) + \beta_2 X_{it}(PE_{it} - PE^*) + \theta I_{it} + e_{it}} \quad (2)$$

Here, the subscript indexes for the individual state and time are i and t respectively; $y_{it}$is the dependent variable- NSDP for sub-nations/states; θI_{it} represents the control variable i.e. capital formation, the independent variable PE_{it} is the public expenditure as well as the threshold variable PE^*. Further, the residual e_{it} follows ($e_{it} \sim N(0, \sigma^2)$. The dummy variable X_{it} is assigned a value of one when the threshold level exceeds PE^* and zero otherwise.

$$\boldsymbol{X_{it} = \begin{cases} 1 \; if \; PE_{it} > PE^* [PE_{greater} = X_{it}(PE_{it} - PE^*)] \\ 0 \; if \; PE_{it} < PE^* [PE_{less} = (1 - X_{it})(PE_{it} - PE^*)] \end{cases}} \quad (3)$$

Thus, in the above equation (3), contingent on the value of the threshold variable PE_{it}-whether It is either above or below the threshold level (PE^*) - the observations are alienated into two regimes: $\beta_1$is estimated when the expenditure is below the threshold level and β_2 is estimated when the expenditure exceeds the threshold level.

Next, to determine the value of PE^*a search is made in the expenditure ratio, over the range 0.001-0.999 (ratio), in increments of 0.001, i.e. the expenditure threshold is among the following values of PE^* (0.001, 0.002, 0.003...0.999) in the regression. An optimum level of expenditure is chosen based on the minimum Sum of Squared Residuals (SSRs).

The model operates under the assumption of a singular threshold effect. To ascertain the statistical significance of this threshold effect at a specific value, the subsequent null hypothesis is investigated:

$H_0: \beta_1 = \beta_2$ (i.e. there is no threshold, $PE^* = 0$)

Under the null hypothesis positing no threshold, the model (as per equation (2)) transforms to:

$$y_{it} = \mu_i + \beta_1 PE_{it} + \theta I_{it} + e_{it} \quad (4)$$

Since this model is designed for non-dynamic panels featuring individual-specific fixed effects, the transformation following the incorporation of fixed effects results as:

$$y'_{it} = \beta_1 PE'_{it} + \theta I'_{it} + e'_{it} \quad (5)$$

Where the regression parameter β_1 is estimated by ordinary least square, yielding the SSRs $S_0 = e'_{it} \sim N(0, \sigma^2)$.

Next, to estimate the threshold level and test against this null hypothesis (H_0), Hansen (1999) computes the subsequent likelihood ratio:

$$F_1 = \frac{S_0 - S_1(PE^*)}{\sigma^2} \quad (6)$$

Where S_0 and $S_1(PE^*)$ are SSRs, under $H_0: PE^* = 0$, i.e. without a threshold effect (from equation (5)) and $H_1 = PE^* \neq 0$, i.e. with a threshold effect (from equation (2)), respectively.

In the bootstrap technique, the first bootstrap sample is constructed by adding a random resample residual e'_{it} to the dependent variable y'_{it} (from the equation (5)). Now using this, hypothesis (equation (2)) is estimated and a bootstrap value of the likelihood ratio statistic -F_1 is calculated from the equation (6).

The bootstrap sample mentioned above is iterated numerous times, specifically 10,000 times in this case. The percentage of iterations where the bootstrap value of the likelihood ratio statistics surpasses the actual value is then calculated. This computation yields the bootstrap estimate of the asymptotic *p*-value for F_1 under H_0. Consequently, the null hypothesis of no threshold effect is refuted if the obtained *p*-value is less than the predetermined critical value. Across all tests, a 5% significance level is adopted as the critical threshold.

3.5 Hypothesis of the study

Present research focuses to analyze the asymmetric non-linear relationship of public expenditure on economic growth, for India and for its six different regions separately (namely, Northern, Western, Southern, Central, Eastern and Northeast). Therefore, for the analysis, the following hypotheses have been established.

The hypothesis to be tested is stated as follows:

H1: Public expenditure has an asymmetric non- linear relationship with economic growth.

The preceding hypothesis is investigated for pan India as well as for the six different regions.

The stated hypothesis is examined for pan India as well as for the six different regions.

H2: There is an inter-regional variation in the effect of public expenditure on economic growth.

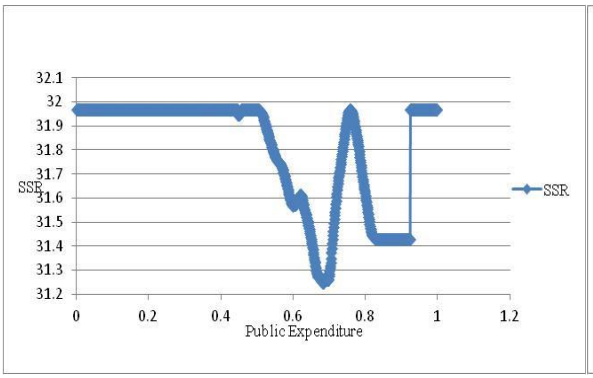
The hypothesis has tested against the null hypothesis, which assumes that there is no relation between dependent (economic growth) and independent variables (public expenditure).

A significance level of 5% has been adopted for all the hypotheses.

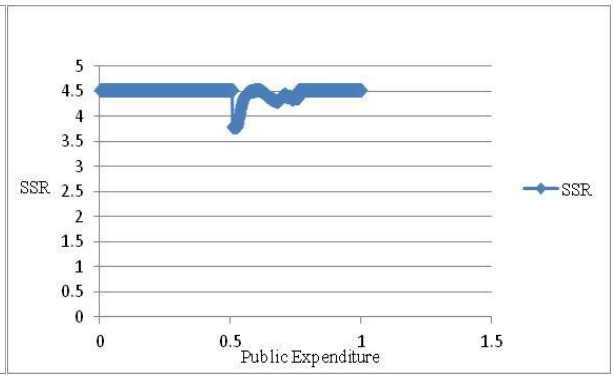
4. Data Analysis and Results

The analytical findings for both the panel of six regions and all of India are addressed in this section; where dependent variable is economic growth, independent variable as well as the threshold variable is the public expenditure and the control variable i.e. capital formation. To investigate for the presence of a threshold effect, the asymptotic *p*-value for *F*1 is computed for all the values of expenditure threshold (0.001, 0.002, 0.003...0.999), in the case of all the seven instances (pan India and six regions respectively). The optimal threshold level (*PE**) is determined at the point where the asymptotic *p*-value for *F*1 is less than the specified critical value, and simultaneously, the Sum of Squared Residuals (SSR) is minimized.

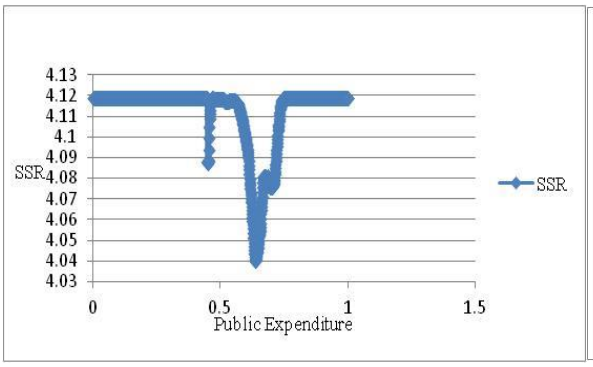
Figure 1 displays the sum of squared residuals (SSR) as a function of public expenditure for pan India and Six respective regions and the threshold level is the point at which SSR is lowest.



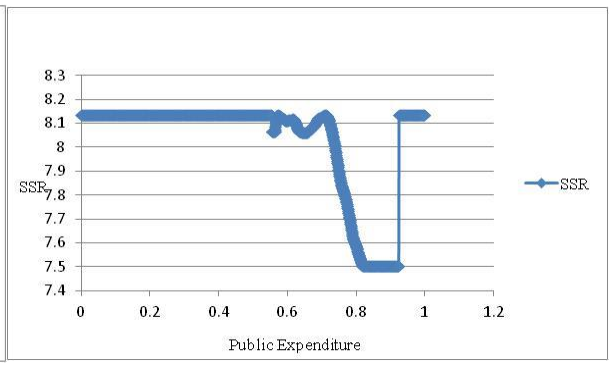
(a) Pan India



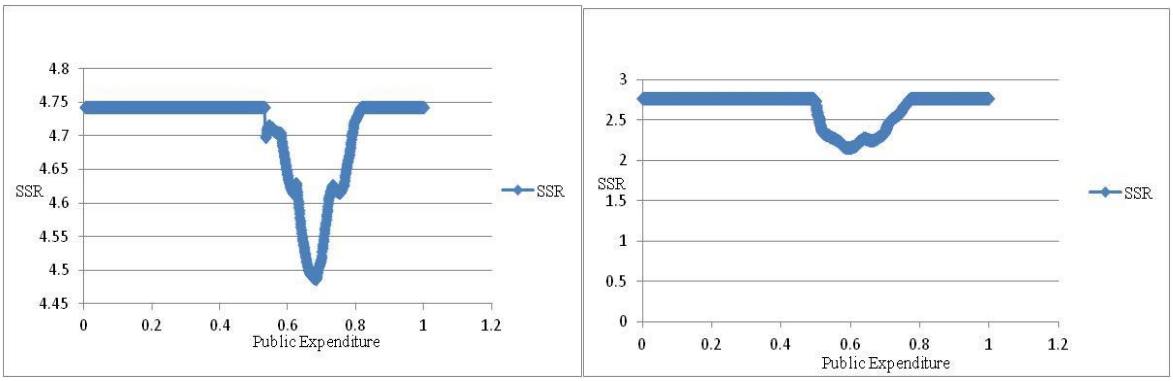
(b) Western Region



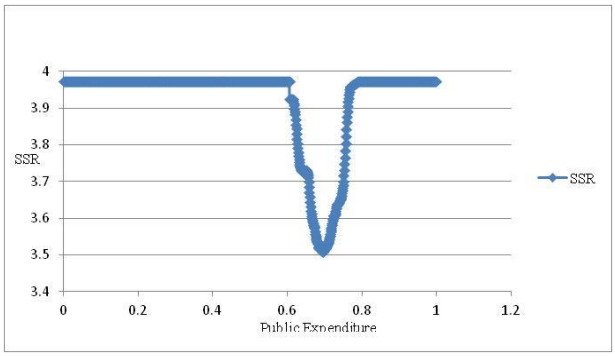
(c)Norten Region



(d) North-eastern Region



(e) Central Region (f) Eastern Region



(g) Southern Region

Figure 1: Sum of squared residuals as a function of public expenditure:

Source: Authors' calculation

The Figure 1 (a) (e) (f) (g) demonstrates that there is no threshold impact for the Central, Eastern, and Southern regions of India (failing to reject the null hypothesis of Hypothesis 1); though SSR is reaching its minimum value in each case however, there is no threshold as the asymptotic *p*-value for *F*1 is greater than the desired critical value. On the other hand, there is a single threshold effect (Figure 1 (b) (c) (d)) of expenditure ratio on the economic growth in case of western (at 50.7%), northern (at 63.5%) and northeastern (at 81.9%) region (rejecting the null hypothesis of Hypothesis 2).

Further, Tables 2 and 3 illustrate how the region's public expenditure and capital formation (independent variables) affect economic growth (dependent variable). Table 2 indicates that for pan-Indian, central, eastern, and southern regions there exists a symmetric linear relationship between public expenditure and economic growth (where we fail to reject the null hypothesis of H1). From the above table, it could also be said that a direct relationship exists between public expenditure and economic growth which is statistically significant. Further, Table 3 shows that an asymmetric non-linear relationship exists between public expenditure and economic growth in the west, north and northeast (where the null hypothesis of H1 is rejected). It could be seen that a threshold exists for Western region @ 50.7 %, Northern region @ 63.5 % and North-eastern region @ 81.9 % respectively, meaning that expenditure beyond this limit would not affect economic growth positively (for Western and Northern regions a statistically insignificant relation exists between $PE_{greater}$ and economic growth) or would affect negatively (for the north-eastern region a statistically significant negative relation exists

between $PE_{greater}$ and economic growth), which could potentially lead to fiscal imbalances. Further, it could also be said that the North-eastern region requires high expenditure as compared to Northern and Western regions since the North-eastern region has a higher threshold (81.9%) level than the Northern and Western regions (63.5% and 50.7%). Consequently, the results indicate that public expenditure affects economic growth differently across the six regions (the null hypothesis of H2 is rejected). Put another way, an inter-regional variation is found in the effect of public expenditure on economic growth.

Table 2: Regression estimates of pan India data, Central region, Eastern region and Southern region states (where threshold does not exist)

	Pan India data		**Central region states**	
Independent variable	*Coefficient*	*Probability*	*Coefficient*	*Probability*
Const.	9.48946	11.1080***	11.1080	2.71e-031***
Public Expenditure	1.98581	1.13739***	1.13739	0.1786**
Capital Formation	0.001399	0.00513307***	0.00513307	1.28e-08***
	Eastern region states		**Southern region states**	
Independent variable	*Coefficient*	*Probability*	*Coefficient*	*Probability*
Const.	9.19171	7.78e-053***	8.02889	4.91E-19***
Public Expenditure	1.87263	4.32e-07***	4.3554	5.15E-05***
Capital Formation	0.00107540	0.0050***	0.000975	0.0454***

Source: Authors' calculation

Note: The notation *** and ** signifies that the values are statistically significant at the 1% and 5% levels, respectively.

Table 3: Regression estimates of Western region, Northern region and North-eastern (with a single threshold)

	Western region *@ 50.7 %*		**Northern region** *@ 63.5 %*		**North-eastern region** *@ 81.9 %.*	
Independent variable	*Coefficient*	*Probability*	*Coefficient*	*Probability*	*Coefficient*	*Probability*
Const.	10.9325	2.89e-058***	*10.9300*	*1.50e-130***	11.1804	7.86E-90***
PE_{less}	9.99617	0.0023***	2.2625	0.0028***	3.19967	5.86E-05***
$PE_{greater}$	2.36958	0.1746	0.7344	0.2990	−6.29468	0.0421**
Capital Formation	0.000981	1.67e-06***	0.0045763	9.92e-011***	0.004258	0.1607

Source: Authors' calculation

Note: The notation *** and ** signifies that the values are statistically significant at the 1% and 5% levels, respectively.

PE less showing regression estimates when public expenditure is less than threshold limit.

PE greater showing regression estimates when public expenditure is greater than threshold limit.

5. Discussion

This study aims to determine the optimal expenditure level, or 'threshold,' at which pan India and six Indian regions can optimize their growth levels. The analysis shows that public spending affects economic growth differently by area. Pan India, central, eastern, and southern regions have a symmetrical relationship between public expenditure and economic growth, whereas western, northern, and northeastern regions have an asymmetrical relationship (Table 3). The result shows that spending contributes positively to economic growth below this barrier but becomes a major worry above it. Let's look at the threshold analysis findings and mitigation points for all the above regions.

In pan India, the Central, Eastern, and Southern regions (Table 2) show 'no threshold' effect of public expenditure at which economic growth is optimal; instead, a linear direct association of expenditure and growth is evident in all regions. India is the world's third-largest economy by market exchange rates (PPP) (Ranjan & Panda, 2022). Since independence, India's economy has undergone transformations. The Planning Commission and now National Institution for Transforming India (NITI Aayog) were created to encourage state governments to participate in bottom-up economic policymaking. Several government projects attempt to enhance per capita monthly income, for example, the Mahatma Gandhi National Rural Employment Guarantee in 2006, Prime Minister's Employment Generation Program in 2008, Aajeevika-National Rural Livelihoods Mission & National Urban Livelihoods Mission in 2011, and Make in India in 2014. These development projects encourage economic growth (Ranjan & Panda, 2022).

India is one of the world's fastest-growing economy, however, economic growth across industries and regions is widespread. Low agricultural growth, low-quality employment, rural-urban split, gender and socioeconomic inequities, restricted human development, and geographical discrepancies are important challenges (Mehra et al., 2018; Majumder et al., 2018). Corruption also hinders inclusive growth in India (Chatterjee and Ray, 2014; Panagariya & Mukim, 2014). Jobless growth and a fall in employment growth relative to economic growth hampered the country's overall performance (Chacko, 2018; Aggarwal & Goldar, 2019). India has a significant journey ahead to attain optimal economic growth.

The economic, social, cultural, geographical, and political differences among Indian regions may also explain the lack of a threshold effect. Additionally, different states operate in different circumstances, so public expenditure needs and economic growth will vary (Meyer et al., 2011; Hota & Behera, 2019; Kumar & Chowdhury, 2020). Therefore, one must investigate how governmental expenditure/budgetary decisions affect economic growth in each location. This covers Uttar Pradesh, Uttarakhand, Chhattisgarh, and Madhya Pradesh. The finding reveals that public spending has no threshold influence on economic growth but a positive linear direct relationship. The central region has a high population density, albeit less than the national average per sq km (exceptions are Uttar Pradesh). High rural population and low literacy rate (excluding Uttarakhand) are key demographic traits. In terms of GDP per capita, this region is among the poorest (excluding MP). Weak infrastructure, remoteness, and social/political marginalization accompany this (Shah, 2007). It's India's largest

vegetable producer. Regional policies encourage IT and biotech industries (especially in UP and somewhat in the states of MP and CT as well). This region has 13 operational and 24 approved Special Economic Zones. Good Governance Index (GGI) ranked above the national average for the region, while Ease of Doing Business (EODB) is also high in this region.

Uttarakhand and Chhattisgarh, as newer states with lower per capita GDP, face challenges in competing with older ones. Uttarakhand could focus on spiritual tourism, yoga, and Ayurveda, leveraging its wildlife and scenic beauty. Meanwhile, Chhattisgarh's strength lies in its mineral resources, including coal, iron ore, dolomite, bauxite, limestone, and quartzite. Both states are making strides toward economic growth and development, showing promise in their advancement despite being relatively young states.

In Eastern India, comprising Bihar, Jharkhand, Odisha, and West Bengal, public spending shows a linear relationship with economic growth, without a threshold effect. However, this region lags behind others in various development indicators such as per capita GDP, birth and mortality rates, life expectancy, literacy, and newborn mortality rates. Despite having a high rural population density and significant government spending on programs like self-help groups (SHGs) and various welfare schemes, these states face challenges in attracting businesses due to poor governance indicators.

Bihar, once considered part of the BIMARU states (Bihar, Madhya Pradesh, Rajasthan, and Uttar Pradesh), has made improvements but still requires substantial growth programs. With 80% of its population engaged in agriculture and a burgeoning food processing, dairy, sugar, manufacturing, and healthcare industry, Bihar's public spending is positively correlated with economic growth. However, there is a need for further investment in growth initiatives.

Southern India, comprising Karnataka, Kerala, Tamil Nadu, and Andhra Pradesh, shows no threshold effect of public spending on economic growth, with a positive correlation between spending and growth. With relatively high per capita GDP, the region benefits from significant government spending, particularly in areas like tourism and IT, leading to sustained economic growth. However, challenges in the agricultural sector persist, with agriculture being the main occupation for many rural residents.

In Western India, comprising Maharashtra, Goa, and Gujarat, there is a threshold effect of public expenditure at 50.7%, beyond which government spending does not contribute to economic growth. Despite higher literacy rates and better infrastructure compared to other regions, Western India faces challenges such as urban population density and dependency on agriculture. However, the region benefits from prominent SEZs and strong industrial growth, particularly in Gujarat, making it a key contributor to India's economy.

Goa stands out with its high literacy rate of 88.7% and moderate population growth rate of 8.23%. The state's progress is supported by industries such as mining and logistics. Given these factors, it can be inferred that public expenditure positively impacts economic growth up to a threshold level of 50.7%. Beyond this threshold, however, public expenditure tends to have a negative impact on economic growth, as indicated in Table 3.

In Northern India, comprising Jammu and Kashmir, Himachal Pradesh, Punjab, Haryana, and Rajasthan, public expenditure exhibits a threshold effect at 63.5%, beyond which economic growth is optimal. There is a positive direct relationship between government spending and economic growth up to this threshold. However, beyond this level, further government spending does not contribute to economic growth.

The Northern states generally have above-average per capita GDP, with literacy rates also above average in most states. The Good Governance Index (GGI) reflects higher results for regions above the national average, indicating relatively better governance. While the region is primarily rural, exceptions like Haryana and Punjab have significant urban populations. Ease of Doing Business (EODB) is less common in this region, except for Haryana and Rajasthan.

Haryana and Punjab, known as India's agricultural bases, have seen improved performance since the green revolution. The government has introduced various initiatives to promote economic growth in these states, such as the National Skill Development Program in 2008, Pradhan Mantri Kaushal Vikas Yojana in 2015, and Pradhan Mantri Yuva Yojana in 2016. These programs receive financial assistance through schemes like the Micro Units Development and Refinance Agency (MUDRA), aimed at fostering economic growth and development in the region.

The government allocates significant funds to rural horticulture and agriculture programs, while metropolitan areas benefit from skill development initiatives in various sectors such as automotive, healthcare, retail, security, IT, beauty and wellness, and sports. The National Capital Region (NCR) has witnessed substantial industrial growth, with Rajasthan's industrial installations and traditional/village tourism strategies contributing to its economic development.

Jammu and Kashmir and Himachal Pradesh boast thriving horticulture sectors, producing apples, various fruits, dry fruits, honey, and saffron. These states also capitalize on their tourism potential to generate income and employment opportunities, contributing to their economic growth.

In the North Eastern Region (NER), which comprises Assam, Meghalaya, Nagaland, Tripura, and Manipur, public expenditure exhibits a threshold effect at 81.9%, beyond which government spending no longer significantly boosts economic growth. Below this threshold, however, public expenditure correlates positively with economic growth, highlighting the region's need for substantial development spending.

The NER faces challenges such as poor per capita income, limited private sector investment, inadequate infrastructure, and geographical remoteness. To address these challenges, the Indian government has implemented initiatives like the State Tribal Sub-Plan (TSP) and the Ministry of Development of North Eastern Region (DONER). These efforts aim to accelerate socioeconomic progress and achieve growth parity between the NER and the rest of the country.

Various sectors such as electricity, border commerce, horticulture, rural infrastructure, and connectivity are being promoted in the NER. Additionally, initiatives like Self-Help Groups (SHGs) and skill training programs address unemployment issues. Projects like the North East Rural Livelihood Project (NERLP) further enhance

rural employment opportunities. Overall, the NER requires substantial capital expenditure compared to other regions, with a threshold of 81.9% for development expenditure to total expenditure.

6. Conclusion

Economic growth serves as a crucial indicator of a nation's financial stability, underscoring the necessity for prudent fiscal policy decisions by governments. Policymakers must be mindful of the threshold for capital spending, beyond which an increase in expenditure may no longer positively impact economic growth and could potentially contribute to fiscal imbalances. This article contributes to fiscal policy literature by incorporating Hansen's (1999) threshold model to examine the influence of public expenditure on economic growth.

Contrary to a fixed threshold, the study reveals a direct relationship between public expenditure and economic growth in India. Regional disparities in social, cultural, geographical, and political environments result in varying public expenditure requirements and, consequently, different effects on economic growth. Among the six regions, the Northern, Western, and North-Eastern regions exhibit a single threshold impact, while the Central, Eastern, and Southern regions show none. Notably, the North-Eastern region has a higher threshold (81.9%) compared to the Northern (60.5%) and Western (50.7%) regions. The findings align more closely with the BARS and Armey Curve for the Northern, Western, and North-Eastern regions, suggesting an optimal expenditure level balancing benefits with economic growth up to a certain point. However, such a correlation is not observed in the results for India's Southern, Central, and Eastern regions.

Policymakers should tailor policies to the diverse social, cultural, and economic characteristics of each region. Successful regional approaches, such as Kerala's focus on human development and Karnataka's emphasis on research and development in the information technology sector, provide valuable insights. Additionally, investing in infrastructure projects proven to positively impact economic growth is crucial, as exemplified by Gujarat's implementation of region-specific policies such as the Sardar Sarovar Dam and industrial corridors. Regular monitoring of regional economic dynamics, demonstrated by Maharashtra's proactive stance, is essential for informed policy adjustments in response to evolving conditions and insights. Policymakers must prioritize fiscal discipline to avoid excessive public expenditure and high fiscal deficits, learning from past instances where overspending led to inflation and economic challenges.

However, it is important to note that this research is specific to India, and the results may not be generalizable to countries with different economic structures. The study acknowledges limitations such as relying on nominal values of variables and not considering varying accounting practices in Indian public finance. Future research could explore the public debt threshold and examine the consequences of public spending decisions on human happiness, enhancing our understanding in this domain.

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