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Optimum government size and economic growth in case of Indian states: Evidence from panel threshold model

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ABSTRACT

This paper investigates the relationship between optimum government size and economic growth using data of Indian states during 1990-91 to 2017–18. Our results derived from panel threshold regression model show a positive and significant impact of government size on economic growth within the estimated thresholds for both aggregate and sub-panels based on income and regions. Once the government size moves above the upper threshold level, then its impact declines and turns to be insignificant. Thus, our findings suggest the policymakers for maintaining the government size within the thresholds limit.

1. Introduction

The notion of government size is well recognized by the researcher and policy makers (Barro, 1990; Karras, 1997; Gunlap and Dincer, 2010; among others). In spite of being a focal point by the researcher over the past decades, the role of government size towards economic growth is unclear and the question of "how government size affects the economic growth" remains ambiguous (for example, some studies find an adverse effect: Landau, 1983, 1985; Barro, 1991; Guseh, 1997; Tanninen, 1999; Folster and Henrekson, 2001; Dar and Amirkhalkhali, 2002; Churchilla and Yew, 2017; Kim et al., 2018, and few find positive effect: Ram, 1986, 1989; Grossman, 1990; Ghali, 1998; Rubinson, 1977).[1] These studies reveal that the government size may uplifts/suppress economic growth in many ways. First, the oversized government suppresses the economic growth due to financing government expenditure through collecting more taxes, rising in borrowings and/or printing more money. Second, in contrast, the small size of government weakens economic growth due to complexities in providing 'public goods.' Moreover, at/or close to optimum government size, an economy works efficiently with positive economic growth, and both private and public sectors are in balance (there is no crowding-out effect). Thus, the significance of the question of the ideal or optimum government size which maximizes the economic growth has emerged an important issue in the past (Sheehey, 1993; Hsieh and Lai, 1994; Christie, 2014; Altunc and Aydin 2013; Asimakopoulos and Karavias, 2016; Hajamini and Falahi, 2018). Also, a bunch of literature emphasizes on expenditure, economic growth, sustainability of fiscal policy, and global financial crises (for example, Mochtar, 2004; Maipita et al., 2010; Silalahi and Chawwa, 2011; Simorangkir, and Adamanti, 2010; Surjaningsih et al., 2012; Kuncoro, 2011; Raz et al., 2012; Febiyansah, 2017; Juanda, 2018; Zhou et al., 2019).

This study aims to investigate the optimum government size which can boost/hinder economic growth in case of Indian states. The main reason being addressing this issue in case of Indian states is due to an increase in various government expenditures over the years. Indian is a federal country where power is distributed between central and state governments. Since the 1990s, the share of expenditure is growing substantially by Indian states which are responsible for widening the vertical and horizontal fiscal imbalance.[2] These imbalances arise due to many factors such as geographical characteristics, population, own revenue generation through limited taxes, and non-tax sources. As a result, inequality in government expenditure is noticed across the Indian states. However, the central government provides the grants-in-aid and introduces many centrally sponsored schemes to eliminate the horizontal and vertical imbalances (Rao, 2005). Since 1990-91 to 2017–18, the government size is widening. The primary reason for a rapid increase in government size, particularly after economic reforms is due to the

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[1] A list of the literature is provided in Appendix A1.

[2] Vertical fiscal imbalance refers widening the gap between central and state governments whereas horizontal fiscal imbalance refers the inter-state disparities.

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Table 1
The trend of government expenditure as a percentage to GSDP. This table reports the decadal trend of expenditure. Results show that expenditure as a percentage to GSDP is increasing over the decade. States like Assam, Bihar, Himachal Pradesh, Manipur, Meghalaya, and Tripura have the highest government size.

States	1990-91 to 1999-00	2000-01 to 2009-10	2010-11 to 2017-18
Andhra Pradesh	10.05	14.35	19.94
Arunachal Pradesh	18.51	34.54	71.24
Assam	5.68	12.67	26.08
Bihar	7.39	15.38	29.48
Goa	7.54	14.44	21.63
Gujarat	6.39	10.74	14.00
Haryana	6.46	9.62	16.21
Himachal Pradesh	10.71	19.48	28.02
Karnataka	4.71	9.13	16.21
Kerala	5.50	9.46	18.06
Madhya Pradesh	6.38	12.94	26.50
Maharashtra	5.12	9.02	13.08
Manipur	14.98	31.47	57.17
Meghalaya	11.31	18.39	37.18
Orissa	6.62	12.26	23.01
Punjab	6.38	12.31	18.58
Rajasthan	6.28	11.32	21.93
Tamil Nadu	5.61	9.94	16.75
Tripura	18.59	28.10	37.78
Uttar Pradesh	6.29	13.64	25.79
West Bengal	5.61	11.33	20.29

introduction of new investments and policies to promote economic growth. At the later stage, many other reforms also have taken to uses expenditure efficiently such as expenditure consolidation measure, targeting fiscal deficit by Fiscal Responsibility and Budget Management (FRBM) Act, Debt Consolidation and Relief Facility (DCRF) and Medium Term Fiscal Reform Programme (MTFRP) through Debt Swap Scheme. Despite these reforms, we see an increasing pattern of government size (see Table 1). We find the largest government size for a state like Arunachal Pradesh, Bihar, Himachal Pradesh, Manipur, Meghalaya, Tripura, and Uttar Pradesh. We also note from Table 1 that states are uneven in terms of their government expenditure due to their geographical characteristics, population, and state own capacity to generate the revenue. Also, we observe an increasing trend of government size over the periods in Table 1.

Moreover, India states total revenue share is around 37.3 percent to India's total revenue during 2013–14. It was 35.9 percent during 1990–91. Whereas the State's expenditure share was about 53.6 percent and increased to approximately 57 percent in 2013–14 (Rao, 2017). This confirms that the state's expenditure share is rising at a higher rate than revenue share, which will enlarge India's government size as a whole. It is also analyzed by Rao (2017) that the expenditure is increasing exponentially across the states from 1990 to 91 to 2017–18, which may hinder economic growth. Thus, an increase in expenditure may tend to rise in borrowings, which may threaten the Indian states government credibility to borrow. Further, the higher imbalance between expenditure and revenue leads to increasing debt to GSDP (gross states domestic product), which creates the insolvency, thereby threaten fiscal sustainability. Therefore, it is essential to maintain government size at an ideal size for states government because they have limited sources to borrow. Thus, it may directly put the pressure on public debt of India and may create the hurdle for the state government's ability to market its debt in the long run, eventually increases the risk of default. In spite, the enhancement in expenditure/debt of state governments in the last decade, but the recent growth slowdown and uncertainty in the financial markets have raised the fresh concerns of optimum government size (RBI reports, 2017–18). The slowdown in growth momentum raises the concern of the revenue capacity of the Indian state's governments, which may also constrain their expenditure capacity and borrowing requirements.

Though, considerable research has been performed on "government size and economic growth" across the globe (see for instances; Ram, 1986, 1989; Grossman, 1990; Ghali, 1998; Rubinson, 1977; Landau, 1983, 1985; , Barro, 1991; Folster and Henrekson, 2001; Dar and Amir Khalkhali, 2002; Churchilla and Yew, 2017; Kim et al., 2018), but studies related to India is scanty except Chandra (2004) who only examines the causality between "government size and economic growth" for India, whereas relationship between "optimum government size and its effect on economic growth" is not investigated in Indian states. Our study complements to Chandra (2004) in many counts. First, we identify the optimum government size and further investigate its effect on economic growth of Indian states. Examining this research question is essential for Indian states, where government size keeps on growing over the years (see Table 1).

Second, this study not only investigates the optimum government size in case of full sample of Indian states but divide states into various panels due to the existence of heterogeneity in terms of government size which arises because of variation in their population, forest, geographical area, etc. (Rao, 2017). Thus, we disaggregate Indian states based on region, northern, southern, eastern, and western; and based on income, high-income, middle-income, and low-income states. We further desegregate the aggregate panel into non-special category states (NSC) and special category states (SC) as Rao (2017) and Reddy and Reddy (2019) mention that NSC government size is relatively lower than the SC.[3] SC incur higher and collect less. In terms of economic growth, NSC states are better than SC (see Table 1). SC gets relatively higher transfers from the central government due to their poor economic performance. The reason for their low economic activity is the remoteness and attached to the international border. Dividing the sample into sub-panels will provide more insight to states.

Third, once the optimum government size is examined, then this study disaggregates total expenditure into three broad compositions (revenue expenditures,[4] capital expenditure,[5] and social sector expenditures[6]), and study the "optimum government size" of these compositions and their impact on economic growth as revenue expenditure is growing faster than capital and social sector expenditure across Indian states.[7] The other reason of disaggregating government size into three main compositions because the recent theoretical literature[8] describes that the relationship between "government size and economic growth" alter with respect to types of expenditure (Barro, 1990; Ghosh and Mourmouras, 2002; Kosempel, 2004; Agenor, 2010; Lee et al., 2017).

To attain our objective, we employ panel threshold regression. Our results derived from panel threshold regression show the existence of two significant thresholds. The findings also indicate that government size has a positive and significant effect on the economic growth between the lower and upper thresholds in case of aggregate sample and sub-panels based on income and regions. However, once the government size moves above the upper limit, then its impact on growth reduces and turned out to be insignificant in the majority of panels.

The remaining part of this study is planned as follows: Section 2 presents the methodology and data sources. Section 3 discusses the empirical results. The final section concludes.

[3] Our data also draw the same inferences (see Table 2).

[4] Expenditure incurred from the current revenue receipts is usually called revenue expenditure. It is grouped in developmental and non-developmental expenditure (for detailes, please refer to Economic and Political Weekly Research Foundation).

[5] Capital expenditure is primarily coming from borrowed funds (or from revenue surpluses) with the object of increasing concrete assets of material and permanent character.

[6] Social sector expenditures refer the expenditure on health and education services.

[7] Refer Table 2.

[8] The theoretical models are summarized in sub-section 2.1, which support our contribution.

2. Methodology and data sources

2.1. Theoretical framework and literature

In this section, we provide the theoretical model which is proposed by Barro (1990, 1991). This framework has considered government sector in an "endogenous-growth" model for the first time. This model assumes that government expenditure-tax income to supply the public services; therefore, there will be the same share for all the producers without experiencing any crowded effect. Barro (1990) has followed AK model which is given as follows:

$$Y(t) = AK(t)^{\beta} G(t)^{1-\beta}, \qquad 0 < \alpha < 1. \tag{1}$$

where Y stands for output, A represents the 'total factor productivity.' K is capital. G stands for the government sector, and the parameter and α measure the output 'elasticity' of capital. β is the parameter of capital.

Eq. (1) can be written in the "constant intertemporal elasticity of substitution (CIES)" structure as follows:

$$u[c(t)] = \begin{cases} \dfrac{c(t)^{1-\sigma}}{1-\sigma}\ \sigma \geq 0,\ \sigma \neq 1,\ and\ \sigma = 1 \\ \ln c(t), \end{cases} \tag{2}$$

where $u[c(t)]$ is a utility function which is based on the CIES. The "equilibrium condition" is given as $Y(t) \equiv C(t) + I(t) + G(t)$. According to Ramsey infinity horizon model, the "steady-state" growth is defined as follows:

$$\frac{\dot{Y}(t)}{Y(t)} = \sigma^{-1}\left[\beta(1-\tau_G)A^{1/\beta}\,\tau_G^{(1-\beta)/\beta} - \delta - \rho\right] \tag{3}$$

where τ_G represents the government size. This will have both positive as well as negative impacts on economic growth. An increase in the share of β leads to the positive effects of "government size on economic growth". As per the study of Barro (1990), productive government expenditure uplifts the economic growth first, then it lessens the growth after a saturation point. This is a nonlinear relationship which also called "Barro curve". This curve uses to find the optimum government size.

Further, the integrated, overlapping generations model (Blanchard, 1985; Mourmouras and Lee, 1999) and Barro (1990)'s "endogenous growth model" assume a user through a "limited horizon" and "logarithmic utility function." To do so, they have mentioned that Barro curve is more general. Ghosh and Mourmouras (2002) found a similar result with Barro curve under the assumption of "perfect capital mobility and finite horizons."

Moreover, the model that advanced by Kosempel (2004) and Agenor (2010) considers two types of government expenditure. First, the government expenditure which provides free services to the public such as park, museum, art galleries and healthcare. These types of expenditures affect the "consumer's utility function" directly:

$$u[c(i,t), x(i,t)] = \begin{cases} \dfrac{(1-\beta)c(i,t)^{1-\sigma} + \beta x(i,t) - 1}{1-\sigma}, & \sigma \geq 0, \sigma \neq 1, \\ (1-\beta)Lnc\ (i,t) + \beta Lnx(i,t), & \sigma = 1 \end{cases} \tag{4}$$

The second type of expenditure government is on the supply side. This type of expenditure allocates for producers to supply free services like as: roads, airports, railways, research and development, and human forces (these are similar to Barro, 1990; Mourmouras and Lee, 1999). Agenor (2010) splatted expenditure into "infrastructure capital and health." These expenditures directly included in the "utility function." Kosempel (2004) has assumed that income comes from proportional taxes. The utility function can be written as $X(t) + G(t) = \tau Y(t) or\ \tau_x + \tau_G = \tau$. The problem of optimization of consumer's utility can be with "finite horizons": '$(U(i,t) = \int_t^{\infty} u[c(i,v), x(i,v)]e^{-(\rho+\lambda)(v-t)}d_v)$' and firm with "finite horizon" '$(\varphi(t) = \int_0^{\infty} u[(1-\ \tau)Y(t) -\ I(t) -\ \omega(t)L(t)]e^{\int_0^t r(u)d_u}d_t)$'. The following equation is derived:

$$\frac{\dot{C}(t)}{C(t)} = \sigma^{-1}\left[\alpha(1-\tau)A^{1/\alpha}\tau_G^{(1-\alpha)/\alpha} - \delta - \rho\right] - \left[\lambda + \rho + (\sigma - 1)\left(\alpha(1-\tau)A^{1/\alpha}\tau_G^{(1-\alpha)/\alpha} - \delta + \lambda\right)\lambda\overline{C}(t)^{-1}\right]\sigma^{-1} \tag{5}$$

$$\frac{\dot{K}(t)}{K(t)} = \sigma^{-1}\left[\alpha(1-\tau)A^{1/\alpha}\tau_G^{(1-\alpha)/\alpha} - \delta\right] - \delta - \overline{C}(t) \tag{6}$$

Here "consumption-capital ratio" is symbolized by $\overline{C}(t)$.

$$\frac{d\left[\frac{\dot{K}(t)}{K(t)}\right]}{d\tau_x} < 0,\quad \frac{d\left[\frac{\dot{C}(t)}{C(t)}\right]}{d\tau_x} < 0,\quad \frac{d\left[\frac{\dot{K}(t)}{K(t)}\right]}{d\tau_G} \gtrless 0,\quad \frac{d\left[\frac{\dot{C}(t)}{C(t)}\right]}{d\tau_G} \gtrless 0$$

The first two derivatives are negative, where the other two are inconclusive. The "steady-state" growth is derived follows:

$$\frac{\dot{Y}(t)}{Y(t)} = \frac{\dot{C}(t)}{C(t)} = \frac{\dot{K}(t)}{K(t)} \tag{7}$$

Hence, an increase in government size leads to shrinking in "steady-state" growth. A modification in "steady-state" growth is directed by $(1-\alpha)(1-\tau_x) - \tau_G$ while τ_G is growing. The "steady-state" growth rises if $(1-\alpha)(1-\tau_x) - \tau_G$ is positive. On the contrary, $(1-\alpha)(1-\tau_x) - \tau_G$ is adverse when there is an increase in τ_G. Therefore, Kosempel (2004) said that Barro curve considers only "second-type expenditure" while first "type-expenditure" adversely impacts the economic growth always. Further, Lee et al. (2017) considering all these studies, and proposed a theoretical model which contained both consumer side (demand) and producer side (supply) expenditures, and reached to the three channels through which economic growth altered by expenditure which are as follows: First, crowding effect, second, spinoff effect, and third, resources mobilization effect (see for more details, Lee et al., 2017). From these theoretical models described above, we observed that the relationship between "government size and economic growth" alters with respect to the type of expenditures (for instance capital expenditure, revenue expenditure, and social sector government expenditure). Hence, this study also investigates the effect of several kinds of the share of government expenditure on economic growth across the Indian states.

2.2. Threshold model

Before employing panel threshold model for investigating the relationship between government size and economic growth, the study uses both Levin et al. (2002, referred as LLC) and Im et al. (2003, referred as IPS) panel unit root investigates the properties of the variables. It is believed that IPS yield more robust results as compare to LLC by allowing heterogeneous coefficients. IPS panel unit root test $t-$ bar test statistic is based augmented Dickey-Fuller statistics averaged across the clubs. LLC test has little power, unlike IPS, to produce consistent results when the deterministic term is present in the analysis. The regression for a sample of N groups over T time periods, the IPS panel unit root regression can be written as:

$$\Delta y_{i,t} = \alpha_i + \pi_i t + \beta_i y_{i,t-1} + \sum_{j=1}^{k} \psi_{i,j} \Delta y_{i,t-1} + \varepsilon_{i,t} \quad (8)$$

where $y$denotes the variable, $\Delta$is a difference operator.$\varepsilon_{i,t}$ is an error term for $i = 1, 2, \ldots, N.$ and. $t = 1, 2, \ldots, T$. The $\Delta y_{i,t-1}$terms on the right-hand side in Eq. (8) allows serial correlation.

Next, we apply a threshold regression model proposed by Hansen (1999, 2000) to attain the goal of this paper. The panel thresholds model is widely used (see, for example, Narayan, and Sharma, 2011; Noor et al., 2014; Surjaningsih et al., 2014). It produces more satisfactory outcome as compared to "cross-sectional" and "time-series models" (Hajamini and Falahi, 2018). This model is based on multiple (J) thresholds. The numerous threshold (J) regression is written as follows:

$$GSDPG_{it} = \alpha_1 POPG_{it} + \alpha_2 EMPG_{it} + \alpha_2 GFCF_{it} + PA_{it} + (\theta_2 + \beta_1 GS_{it}).I(GS_{it} \leq \gamma_1) + \sum_{j=2}^{J} (\theta_j + \beta_j GS_{it}).I(\gamma_{j-1} < GS_{it} \leq \gamma_1) + (\theta_{j+1} + \beta_{j+1} GS_{it}).I(GS_{it} > \gamma_j) + \varepsilon_{it} \quad (9)$$

where $(.)I$ represent the index function, and γ stands for thresholds. The error term is given as $\varepsilon_{it} = \mu_i + \lambda_t + \upsilon_{it}$, where μ_i indicate states unobserved specific effect such as social and political structure, and abundant natural resources; λ_t is regarding time-specific effect such as exogenous shocks, regional and global crises. *GSDPG* stands for real gross states domestic growth. *GS* represents the government size, which defined as the share of government spending in *GSDP*. *POPG* and *EMPG* represent population and employment growth. *GFCF* indicates the gross fixed capital formation as a percentage to *GSDP*. *PA* stands for political alignment.

By following Chen and Lee (2005) and Hajamini and Falahi (2018), the theoretical model (see, Eq. (3)) proposed by Barro (1990) is augmented with other vital control variables such as population growth which reduces the economic growth and decreases the standard of living (as Malthus argued), and reduction in the resources as more individual use inevitably them. Population growth also affects the other vital factors such as age, international migration, economic inequality, and the size of a country's workforce, thereby reduces the overall output. The other important factor of economic growth is employment which positively contributes to economic growth. The Okun's law also suggests that higher unemployment leads to reduce economic growth. On the other hand, this law says that higher employment boosts economic growth. Similarly, gross fixed capital formation is another important determinant of economic growth. Gross fixed capital formation is nothing but the net investment on plant, machinery, and equipment purchases; the construction of roads, railways, private residential dwellings, and commercial and industrial buildings. As per the Keynesian theory, higher investment boosts economic growth via higher output. The details of investment spending are also briefly explained in section 2.1. We further augment Eq. (9) by including political alignment (*PA*). The *PA*is mostly helpful in a country like India, where the power for taxation and spending are divided between central and state governments. It is believed that better outcome prevails when different levels of government are politically aligned since politicians are jointly responsible for several policies (Arulampalam et al., 2009; Asher, and Paul, 2017). Political alignment may have an adverse effect on the economic growth due to high central transfers to states, which reduces the capacity to generate their own revenue as results dampen the overall economic performance states.

Chan (1993) and Hansen (1999) obtained a "minimum of sum of squared residuals from a consistent estimation". Hajamini and Falahi (2018) state that the thresholds are computed from "smallest to largest" to avoid the complexity:

$$\begin{aligned} &\widehat{\gamma}_1 = argmin\ S_1(\gamma_1), \\ &\widehat{\gamma}_2 = argmin\ S_2(\gamma_2 | \widehat{\gamma}_1) \\ &\vdots \\ &\widehat{\gamma}_J = argmin\ S_2(\gamma_2 | \widehat{\gamma}_1, \ldots, \widehat{\gamma}_{J-1}) \end{aligned} \quad (10)$$

From Eq. (9), null of thresholds are indicated below:

$$\begin{aligned} &\gamma_1 : H_0^1 : \beta_1 = \beta_2, \qquad H_1^1 : \beta_1 \neq \beta_2, \\ &\gamma_2 : H_0^2 : \beta_2 = \beta_3, \qquad H_1^2 : \beta_2 \neq \beta_3, \\ &\qquad \vdots \\ &\gamma_J : H_0^J : \beta_J = \beta_{J+1}, \qquad H_1^J : \beta_J \neq \beta_{J+1}, \end{aligned} \quad (11)$$

The hypothesis from Eq. (10) is tested by $F_i$statistics:

$$\begin{aligned} &F_1 = \frac{S_0 - S_1(\widehat{\gamma}_1)}{\widehat{\sigma}_1^2}, \\ &F_1 = \frac{S_1(\widehat{\gamma}_1) - S_2(\widehat{\gamma}_2 | \widehat{\gamma}_1)}{\widehat{\sigma}_1^2}, \\ &\vdots \\ &F_J = \frac{S_{J-1}(\widehat{\gamma}_{J-1} | \widehat{\gamma}_1, \ldots, \widehat{\gamma}_{J-2}) - S_J(\widehat{\gamma}_J | \widehat{\gamma}_1, \ldots, \widehat{\gamma}_{J-1})}{\widehat{\sigma}_J^2} \end{aligned} \quad (12)$$

whereS_0 represents the "residual of sum of squares". The null of no Jth threshold (s) is rejected if F-statistics values are significant. However, the 'F-distribution' is "non-standard" to rely on "sample-moments", thus critical-values are not tabulated. To obtained the critical values, the bootstrap procedure should be performed as suggested by Hansen (1999, 2000). From Eq. (9), we can expect a positive/negative sign as discussed in the literature above, where control variables' sign and significance level may vary. We expect a negative relationship between *POPG* and economic growth as the higher population growth hinder economic growth. On the contrary, we expect a positive relationship with *GSDPG* of other variables such as *EMPG*, and *GFCF*. *PA* will be positive if alignment between the central and states government is working efficiently (Arulampalam et al., 2009; Asher, and Paul, 2017).

2.3. Endogeneity

We suspect endogeneity because sometimes higher growth might lead to more expenditure and vice-versa (Slemrod et al., 1995; Conte and Darrat, 1988; Agell et al., 2006; Afonso and Furceri, 2010; Wu et al., 2010; Thamae, 2013; Christie, 2014; Asimakopoulos and Karavias, 2016; Hajamini and Falahi, 2018). We use the following equations to check the endogeneity in the data.

$$GSDPG_{it} = \alpha_i + \beta GS_{it-1} + \varepsilon_{it} \quad (13)$$

$$GS_{it} = \mu_i(1-\rho) + \rho GS_{it-1} + \epsilon_{it} \quad (14)$$

$$\varepsilon_{it} = \gamma_i \epsilon_{it} + \eta_{it} \quad (15)$$

where $GSDPG_{it}$ and GS_{it} indicate the GSDP growth and government size respectively whereasε_{it} ϵ_{it} and η_{it} are the error of GSDP growth, government size, and combined error, respectively. We reject the null of no endogeneity hypothesis if $H_0 : \gamma_i = 0$. In the presence of endogeneity, the non-dynamic thresholds model may not provide consistent estimates; thus, first, we check the endogeneity using Eq.(13)–(15).

2.4. Data sources

This study covers a sample of 25 Indian states taking the period from 1990 to 91 to 2017–18. Data is collected from the multiple sources, for instance, Gross State Domestic Products (*GSDP*, 2011–12) and expenditures (such total expenditure, social sector expenditure, revenue expenditure, and capital expenditure) data collected from Economic and Political Weekly Research Foundation (EPWRF). The employment data is taken from various sources such as EPWRF, Indiastat, and ministry of labour and employment government of India. We compile all series in a common unit for our analysis. The gross fixed capital of formation (*GFCF*) collected from the states finance report published by Reserve Bank of India. The information related to state and central governments' ruling parties is collected from the Election Commission of India. We measure political alignment by creating a dummy variable. We assign '1' if both central and state are ruling by the same government or their alliance, otherwise '0'. We consider 25 Indian states which are as follows: Andhra Pradesh (combined with Telangana), Assam, Arunachal Pradesh, Bihar (combined with Jharkhand), Goa, Gujarat, Haryana, Himachal Pradesh, Karnataka, Kerala, Madhya Pradesh (combined Chhattisgarh), Maharashtra, Manipur, Meghalaya, Odisha, Punjab, Rajasthan, Tamil Nadu, Tripura, Uttar Pradesh (combined with Uttarakhand) and West Bengal. More details on the classification of states are provided in Appendix A2.

3. Empirical results and discussions

3.1. Preliminary analysis

This section began by presenting the patterns of government size and *GSDP* growth (*GSDPG*) in Table 2. Table 2 indicates that the *GSDPG* and government size for full sample is around 6.92% and 16.05%, respectively. While we compare SC with NSC, we find that the *GSDPG* (i.e., 7.18) is relatively higher as compared to SC, whereas in terms of government size (*GS*), SC has the larger *GS*. We further divide states based on the income and regions. We find that the *GSDPG* is lower and *GS* is larger in the low-income group states, unlike middle and high-income group states where there is higher *GSDPG* with smaller *GS*. In case of regions, we find that western and northern region both have smaller *GS* along with higher *GSDPG*. From, these findings, we observe that sub-panels like SC states, low-income group, eastern states are lower in terms of *GSDPG* but higher in terms of *GS*. This implies that these sub-panels are spending higher with lower *GSDPG*, which might raise the questions of their credibility. Also, this sub-group are receiving higher transfers from the central government as compared to other sub-group (Rao, 2017). Larger government size may reduce the economic growth due to financing government expenditure through collecting more taxes and rising in borrowings. We, further, disaggregate government size into three broad compositions such as government size based on revenue expenditure (*GS*1), government size based on capital expenditure (*GS*2) and government size based on social sector expenditure (*GS*3). Our results in Table 2 show that *GS*1 is highest across the full sample and sub-panels as compare to *GS*2 and *GS*3.

In the next step, we check the panel unit root test of all the indicators by using the LLC and IPS unit root test. The results provided in Table 3 show that the null of panel unit root can be rejected at least for all the variables such as GSDPG, POPG, EMPG, and GFCF except government size. In other words, we find that GSDPG, POPG, EMPG, and GFCF series are stationary at 1% level of significance.

3.2. Results of optimum government size and economic growth

Before, investigating the optimum government size and its effect on economic growth, first, we check the endogeneity between *GSDPG* and *GS*. Our results presented in Table 4 show that there is no evidence of

Table 4
Results of endogeneity test for panel data. GSDPG stands for gross of state domestic product growth. GS means government size. There is no endogeneity in the data.

	Coefficient	*p*-value	H_0:there is no endogeneity
GS	−0.11	0.36	we do not reject the null hypothesis of endogeneity

Table 2
Summary of the results. NSC stands for non-special category states. SC = denotes special-category states. LIG, MIG, and HIG stand for low-, middle-, and high-income group states, respectively. NR, SR, ER, and WR denote the northern, southern, eastern and western region respectively. *GSDPG* stands for gross state domestic products growth. *GS*denotes the government size. *GS*1is government size based on the revenue. *GS*2 refers to the government size based on capital expenditure, whereas *GS*3 is the government size based on the social sector expenditure. NSC states are better in terms of gross state domestic product growth (GSDP) as compare to SC GSDPG. In terms of government size, SC, LIG, NR, and WR have a larger government size.

Variables	Mean									
	Full sample	NSC	SC	LIG	MIG	HIG	NR	SR	ER	WR
GSDPG	6.92	7.18	6.25	6.91	7.00	7.64	6.43	7.63	6.33	7.99
GS	16.05	12.22	25.62	14.28	11.66	10.73	13.64	11.21	22.08	11.85
*GS*1	12.45	9.73	19.25	11.11	9.48	8.60	10.74	9.06	16.77	9.35
*GS*2	3.60	2.49	6.37	3.17	2.18	2.13	2.90	2.15	5.32	2.50
*GS*3	9.62	9.68	9.47	5.47	4.18	19.38	4.72	4.25	8.23	23.89

Table 3
Panel unit root results. GSDPG is the growth of gross state domestic product. *GS* denotes the government size. *POPG* is the population growth. *EMPG* stands for employment growth. *GFCF* is a gross fixed capital formation that is measured as a percentage of GSDP. LLC and IPS refer the Levin, Lin, and Chu and Im, Pesaran, and Shin respectively. Results show that all the series are stationary except *GS*. **** denotes the 1% level of significance. p-values are given in the parenthesis.

	LLC		IPS	
Variables	Constant	Constant with trend	Constant	Constant with trend
GSDPG	−17.88***(0.00)	−16.03***(0.00)	−18.03***(0.00)	−16.87***(0.00)
GS	13.29 (1.00)	4.90 (1.00)	16.66 (1.00)	6.47 (1.00)
POPG	−17.92***(0.00)	−17.90***(0.00)	−15.27***(0.00)	−15.05*** (0.00)
EMPG	−3.98*** (0.00)	−0.75 (0.22)	−6.90*** (0.00)	−4.33*** (0.00)
GFCF	−3.14*** (0.00)	−3.81*** (0.00)	−4.16*** (0.00)	−5.34*** (0.00)

endogeneity since the coefficient of error of government size is turn to be insignificant. Hence, a non-dynamic threshold can provide consistent results in the absence of endogeneity.

To do so, first, we test the significance of the thresholds. In other words, we test how many thresholds are significant for full sample and sub-panels using the Hansen panel threshold regression model. The results in Table 5 show the existence of two significant thresholds (or two significant optimum government sizes) exist for full samples, as we reject the single and triple thresholds since *F*-statistic values are insignificant. In case of sub-panel based on NSC, we find two significant thresholds for *GS*. There are two significant thresholds of *GS* exist for SC too. We further note two significant thresholds of *GS* in low and middle-income group states, whereas, in case of the high-income group, no significant threshold is noticed. In case of sub-panel based on regions, we find two significant thresholds of *GS*. Overall, these findings suggest that there is two optimum government size occur across the full sample and sub-panels where state government may attain high economic growth.

In the next step, we find the optimum government size (or thresholds) for full sample and sub-panels. The results presented in Table 6 show that the lower and upper optimum government size (*GS*) for full sample is found to be around 4.85% and 5.75% respectively. In the case of NSC states, it is noticed around 4.55% and 6.07% respectively. Similarly, for SC, the lower and upper optimum government sizes (i.e., 34.70% and 38.55%) are higher than the NSC optimum government sizes. This suggests that SC states have larger government size as compare to NSC states. The reason for the difference between optimum thresholds of NSC and SC states is that SC states spend more and their revenue generation capacity is low. As a result, their per capita income is low. On the contrary, the majority of the NSC states are good in terms of their per capita income and revenue generation (Rao, 2017; Reddy and Reddy, 2019). The NSC states expenditure also relatively low as compared to SC states, as our data also reflect the same inferences in Table 2. Further, we find 5.96% and 6.06% lower and upper optimum *GS*, respectively for low-income group states. The lower and upper optimum government sizes are noticed around 15.41% and 15.91% respectively for middle-income group states. This finding shows that middle-income group states are in the higher side in terms of their government sizes as compared low-income group. Whereas in the case of high-income group states, we did not find the existence of any significant optimum government size. While looking at government sizes based on the regions, we find that

Table 5

Test for single/double/triple threshold. NSC stands for non-special category states. SC = denotes special-category states. LIG, MIG, and HIG stand for low-, middle-and high-income group states respectively. NR, SR, ER, and WR denote the northern, southern, eastern and western region respectively. *GS* denotes the government size. Results show the existence of two significant thresholds for full sample and sub-panels except for HIG. ***, ** and * denotes the significance level at 1%, 5% and 10%, respectively. p-values are given in the parenthesis.

Variables	Full Sample	NSC	SC	LIG	MIG
GS	*F*-stat	*F*-stat	*F*-stat	*F*-stat	*F*-stat
Test for single threshold	4.12 (0.67)	4.65 (0.65)	4.31 (0.41)	7.27 (0.44)	5.41 (0.60)
Test for double threshold	42.91***(0.00)	41.83***(0.00)	8.33**(0.03)	26.69* (0.06)	18.22*(0.08)
Test for triple threshold	2.49 (0.83)	3.77 (0.87)	4.52 (0.29)	3.84 (0.57)	4.54 (0.60)
GS	HIG	NR	SR	ER	WR
Test for single threshold	2.86 (0.62)	1.70 (0.90)	5.61 (0.65)	5.19 (0.51)	8.01 (0.17)
Test for double threshold	3.13 (0.59)	30.77***(0.00)	43.07***(0.01)	48.33***(0.00)	19.15**(0.02)
Test for triple threshold	5.49 (0.54)	5.29 (0,26)	2.20 (0.80)	3.52 (0.88)	2.72 (0.48)

Table 6

Threshold estimate. NSC stands for non-special category states. SC = denotes special-category states. LIG, MIG, and HIG stand for low-, middle-and high-income group states respectively. NR, SR, ER, and WR denote the northern, southern, eastern and western region respectively. *GS* denotes the government size. γ_1^r and γ_2^r show the lower and upper thresholds. Results reported in this show the existence of thresholds for full sample and sub-panels except for HIG.

GS	Full	NSC	SC	LIG	IG	HIG	NR	SR	ER	WR
γ_1^r	4.85	4.55	34.70	5.96	15.41	…	10.03	11.54	5.96	4.94
γ_2^r	5.09	6.07	38.55	6.06	15.91	…	10.55	11.75	6.05	5.08

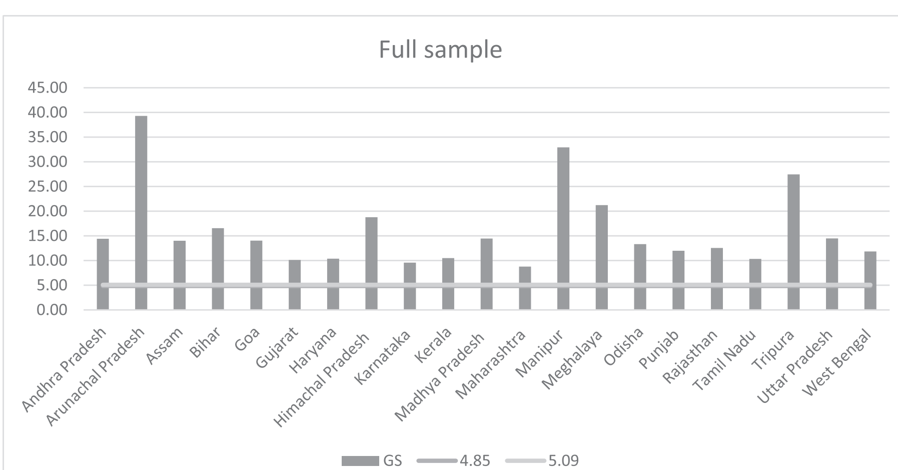

Fig. 1. The plot of the *GS* and optimum thresholds. It is observed from this figure that states like Andhra Pradesh, Gujrat, Haryana, Karnataka, Kerala, Maharashtra, Odisha, Punjab, Tamil Nadu, Uttar Pradesh, and West Bengal have smaller government size as compared to states like Arunachal Pradesh, Himachal Pradesh, Manipur, and Tripura.

Table 7
Regression estimate of single/double threshold model for GS. NSC stands for non-special category states. SC = denotes special-category states. LIG, MIG, and HIG stand for low-, middle-and high-income group states respectively. NR, SR, ER, and WR denote the northern, southern, eastern and western region respectively. *GS* denotes the government size. *POPG* and *EMPG* indicates the population and employment growth. *GFCF* is the gross fixed capital formation as a percentage to GSDP. PA is the political alignment. Results presented in this that show a positive and significant relationship between *GS* and *GSDPG* between the upper and lower thresholds for full sample and sub-panels. However, below and above the thresholds level, the coefficients of *GS* turn to insignificant. ***, ** and * denotes the significance level at 1%, 5% and 10%, respectively. p-values are given in the parenthesis.

Full samples		NSC		SC	
Variables	Coefficients	Variables	Coefficients	Variables	Coefficients
POPG	−0.51***(0.00)	*POPG*	−0.52***(0.00)	*POPG*	−0.15 (0.27)
EMPG	0.02*(0.09)	*EMPG*	0.02**(0.05)	*EMPG*	0.001 (0.88)
GFCF	0.27**(0.04)	*GFCF*	0.26*(0.10)	*GFCF*	0.49 (0.11)
PA	1.28**(0.04)	*PA*	1.96**(0.02)	*PA*	0.09 (0.89)
$GS < 4.85$	−0.23 (0.44)	$GS < 4.55$	0.06 (0.79)	$GS < 34.70$	0.06(0.25)
$4.85 \leq GS \leq 5.88$	4.18*** (0.00)	$4.55 \leq GS \leq 6.07$	3.83***(0.00)	$34.70 \leq GS \leq 38.55$	0.17***(0.01)
$5.88 < GS$	0.004 (0.89)	$6.07 < GS$	0.03 (0.55)	$38.55 < GS$	0.01 (0.56)
LIG		MIG		NR	
POPG	−0.78(0.41)	*POPG*	−0.78***(0.00)	*POPG*	−0.17 (0.67)
EMPG	0.03(0.20)	*EMPG*	0.01(0.44)	*EMPG*	−0.01 (0.32)
GFCF	0.47(0.26)	*GFCF*	−0.13 (0.83)	*GFCF*	0.22 (0.15)
PA	1.91 (0.34)	*PA*	1.64(0.17)	*PA*	0.62 (0.39)
$GS < 5.96$	0.60 (0.31)	$GS < 15.41$	0.23(0.19)	$GS < 10.03$	0.001(0.99)
$5.96 \leq GS \leq 6.07$	4.61***(0.00)	$15.41 \leq GS \leq 15.91$	1.90***(0.00)	$10.03 \leq GS \leq 10.55$	1.06***(0.00)
$6.07 < GS$	0.06 (0.63)	$15.91 < GS$	0.09 (0.39)	$10.55 < GS$	0.03 (0.62)
SR		ER		WR	
POPG	−0.28***(0.00)	*POPG*	−0.33 (0.54)	*POPG*	−0.53 (0.15)
EMPG	0.01 (0.63)	*EMPG*	0.02 (0.13)	*EMPG*	0.02 (0.36)
GFCF	−0.22 (0.73)	*GFCF*	0.36 (0.19)	*GFCF*	0.30 (0.50)
PA	2.41* (0.07)	*PA*	−0.56 (0.60)	*PA*	4.99*** (0.00)
$GS < 11.54$	0.44 (0.13)	$GS < 5.96$	−0.24 (0.49)	$GS < 4.94$	−0.51 (0.59)
$11.54 \leq GS \leq 11.75$	3.36***(0.00)	$5.96 \leq GS \leq 6.05$	3.41***(0.00)	$4.94 \leq GS \leq 5.08$	4.90***(0.00)
$11.75 < GS$	0.24 (0.13)	6.05<GS	0.02 (0.49)	$5.08 < GS$	−0.01 (0.90)

Table 8
Test for single/double/triple threshold of GS1, GS2, and GS3.*GS*denotes the government size. *GS*1is government size based on the revenue. *GS*2 refers to the government size based on capital expenditure, whereas *GS*3 is the government size based on the social sector expenditure. NSC stands for non-special category states. SC = denotes special-category states. LIG, MIG, and HIG stand for low-, middle-and high-income group states respectively. NR, SR, ER, and WR denote the northern, southern, eastern and western region respectively. Results show the existence of two significant thresholds of GS1 for full sample, LIG, MIG, ER and WR and sub-panels except for HIG. Presence of two significant thresholds of GS2 finds for full samples, NSC, LIG, SR, ER, and WR. Results show two significant thresholds of GS1 for full sample, LIG, MIG, HIG, NR, SR, ER, and WR. ***,**, and * indicate the significance level at 1%, 5%, and 10% , respectively. p-values are given in the parenthesis.

	Full Sample	NSC	SC	LIG	MIG
*GS*1					
Test for single threshold	4.41 (0.66)	6.24 (0.42)	4.15 (0.41)	6.90 (0.48)	3.98 (0.74)
Test for double threshold	12.86**(0.04)	3.45 (0.79)	3.50 (0.58)	27.14***(0.01)	16.98**(0.04)
Test for triple threshold	2.22 (0.86)	2.73 (0.78)	5.35 (0.19)	4.06 (0.59)	3.73 (0.55)
*GS*2					
Test for single threshold	8.62 (0.27)	7.33 (0.37)	8.98 (0.13)	23.66***(0.00)	3.33 (0.80)
Test for double threshold	39.35***(0.00)	53.87***(0.00)	6.36 (0.25)	52.96***(0.00)	2.21(0.82)
Test for triple threshold	6.86 (0.63)	4.16 (0.86)	5.54 (0.59)	2.49 (0.77)	3.78 (0.62)
GS3					
Test for single threshold	3.72 (0.83)	4.76 (0.64)	4.15 (0.38)	5.44 (0.66)	4.38 (0.53)
Test for double threshold	15.42***(0.00)	8.08 (0.31)	3.12 (0.62)	22.11* (0.09)	68.86***(0.00)
Test for triple threshold	4.02 (0.62)	3.78 (0.85)	2.60 (0.66)	3.07 (0.76)	1.18 (0.96)
	HIG	NR	SR	ER	WR
*GS*1					
Test for single threshold	4.10 (0.42)	3.05 (0.84)	4.94 (0.39)	5.82 (0.50)	6.16 (0.36)
Test for double threshold	7.14 (0.35)	5.70 (0.35)	11.91 (0.17)	47.29***(0.00)	18.01**(0.03)
Test for triple threshold	4.15 (0.51)	4.88 (0.59)	2.71 (0.93)	4.00 (0.60)	3.98 (0.34)
*GS*2					
Test for single threshold	2.64 (0.80)	4.67 (0.61)	2.17 (0.75)	14.49*** (0.01)	3.61 (0.78)
Test for double threshold	−0.45 (1.00)	8.16 (0.20)	43.66***(0.00)	45.27***(0.00)	15.41***(0.00)
Test for triple threshold	4.16 (0.47)	7.19 (0.70)	0.62 (0.99)	7.38 (0.42)	1.48 (0.90)
*GS*3					
Test for single threshold	17.28**(0.02)	2.22 (0.76)	3.58 (0.87)	5.52 (0.49)	7.16 (0.21)
Test for double threshold	19.88** (0.02)	11.37*(0.10)	43.86***(0.00)	43.47***(0.00)	23.25***(0.00)
Test for triple threshold	18.16* (0.08)	8.95**(0.06)	1.38 (0.86)	4.18 (0.53)	10.00 (0.13)

southern states and northern states have a larger government size.

After confirming the significant thresholds, this study plots all the government size series against to estimated thresholds in Fig. 1 for further assessments. It is observed from Figs. 1,[9] that states like Andhra Pradesh, Gujrat, Haryana, Karnataka, Kerala, Maharashtra, Odisha, Punjab, Tamil Nadu, Uttar Pradesh, and West Bengal have smaller government size as compared to states like Arunachal Pradesh, Himachal Pradesh, Manipur, and Tripura. On the overall, these observations

[9] To conserve the space, we do not provide sub-panels figures.

Table 9
Threshold estimate for GS1, GS2 and GS3. γ_1^r and γ_2^rindicate the lower and upper estimated thresholds.*GS*denotes the government size. *GS*1is government size based on the revenue. *GS*2 refers to the government size based on capital expenditure whereas *GS*3 is the government size based on the social sector expenditure. NSC stands for non-special category states. SC = denotes special-category states. LIG, MIG, and HIG stand for low-, middle-and high-income group states respectively. NR, SR, ER, and WR denote the northern, southern, eastern and western region respectively. Results reported in this show the existence of thresholds.

	Full	NSC	SC	LIG	MIG	HIG	NR	SR	ER	WR
*GS*1										
γ_1^r	3.35	…	…	5.16	12.23	…	…	…	5.17	4.19
γ_2^r	4.44	…	…	5.31	12.24	…	…	…	5.85	4.30
*GS*2										
γ_1^r	0.80	0.80	…	0.77	…	…	…	3.94	0.68	0.77
γ_2^r	0.77	0.78	…	0.80	…	…	…	3.68	0.80	078
*GS*3										
γ_1^r	3.78	…	…	2.63	3.43	35.02	3.76	3.43	2.42	1.95
γ_2^r	4.26	…	…	2.42	3.90	95.79	4.27	3.73	2.65	2.01

suggest to the government (s) that the government size may be equal or close to the optimum government size to maintain the balance in the budget deficit and enjoy the high economic growth. As it is believed that larger government size suppresses the economic growth due to financing government expenditure through borrowings and collecting more taxes. The small size of government weakens economic growth due to complexities in providing 'public goods.' Moreover, at/or close to optimum government size, an economy works efficiently with positive economic growth, and both private and public sectors are in balance, and there is no crowding-out effect.

Next, the relationship between optimum government size and economic growth is established with the help of threshold regressions, and results are presented in Table 7. The results show that 1% increase in the *GS* leads to an increase of 4.18% in *GSDPG* when *GS* is between 4.85% and 5.09% in case of full sample. This implies that between these thresholds, states work efficiently, and there would not be any provision for state of crowding-out effect. The government size does not have any significant impact on *GSDPG* above and below the estimated thresholds in case of full sample. However, below and above the estimated threshold, the magnitude of government size is declining and turn to insignificant which implies that smaller and larger government size weakens economic growth due to difficulties in providing public goods and crowding out effect, respectively (Ram, 1986; Gwartney et al., 1998; Hajamini and Falahi, 2018). Further, the same relationship is conducted in case of NSC, SC, and sub-panels based on the income and regions. The similar findings are noticed for NSC and SC states and sub-panels. The other control variables like population growth, employment growth, gross fixed capital formation, and political alignment do corroborate as per a priori expectation. However, the significant level varies across the sub-panels.

3.3. *Compositions of government size*

In the next stage, a similar analysis is repeated for three broad compositions of government size *GS*1, *GS*2 and *GS*3. The results presented in Table 8 show that there is an existence of two thresholds for full panel, lower and middle-income group states, and all the regions. Similarly, we find two significant thresholds of *GS*2 in case of full panel, NSC states,

Table 10
Regression estimate of single/double threshold model for GS1, GS2, and GS3. NSC stands for non-special category states. SC = denotes special-category states. *GS*denotes the government size. *GS*1is government size based on the revenue. *GS*2 refers to the government size based on capital expenditure, whereas *GS*3 is the government size based on the social sector expenditure. *POPG* and *EMPG* indicates the population and employment growth. *GFCF* is the gross fixed capital formation as a percentage to *GSDP*. PA is the political alignment. Results presented in this that show a positive and significant relationship between *GS*1 and *GSDPG* between the upper and lower thresholds for full sample. GS2 positively affect the GSDPG in case of full sample and NSC within the threshold limit. ***, ** and * denotes the significance level at 1%, 5% and 10%, respectively. p-values are given in the parenthesis.

Full samples		NSC		SC	
Variable	Coefficients	Variable	Coefficients	Variable	Coefficients
*GS*1					
POPG	−0.52***(0.00)	…	…	…	…
EMPG	0.01 (0.16)	…	…	…	…
GFCF	0.43***(0.01)	…	…	…	…
PA	1.24**(0.05)	…	…	…	…
*G*1 < 3.35	−0.21 (0.51)	…	…	…	…
3.35 ≤ *GS*2 ≤ 4.44	2.30***(0.00)	…	…	…	…
4.44 < *GS*1	−0.11 (0.81)	…	…	…	…
*GS*2					
POPG	−0.51***(0.00)	*POPG*	−0.51***(0.00)	…	…
EMPG	0.01* (0.09)	*EMPG*	0.01 (0.11)	…	…
GFCF	0.28*(0.08)	*GFCF*	0.22 (0.23)	…	…
PA	1.18**(0.05)	*PA*	1.27 (0.12)	…	…
*GS*2 < 0.80	−0.54 (0.77)	*GS*2 < 0.80	0.42 (0.77)	…	…
0.80 ≤ *GS*2 ≤ 0.77	20.97***(0.00)	0.80 ≤ *GS*2 ≤ 0.78	0.33***(0.00)	…	…
0.77 < *GS*2	0.09 (0.37)	0.78 < *GS*2	0.38*(0.09)	…	…
*GS*3				…	…
POPG	0.51***(0.00)	…	…	…	…
EMPG	0.01* (0.09)	…	…	…	…
GFCF	0.29*(0.08)	…	…	…	…
PA	1.38**(0.03)	…	…	…	…
*GS*2 < 3.78	0.33 (0.19)	…	…	…	…
3.78 ≤ *GS*3 ≤ 4.26	−0.87***(0.01)	…	…	…	…
4.26 < *GS*3	0.02 (0.36)	…	…	…	…

Table 11
Regression estimate of single/double threshold model for GS1, GS2, and GS3. NR, SR, ER, and WR denote the northern, southern, eastern and western region respectively. *GS*denotes the government size. *GS*1is government size based on the revenue. *GS*2 refers to the government size based on capital expenditure, whereas *GS*3 is the government size based on the social sector expenditure. *POPG* and *EMPG* indicates the population and employment growth. *GFCF* is the gross fixed capital formation as a percentage to *GSDP*. *PA* is the political alignment. Results presented in this that show *GS*1and *GS*2have a positive and significant relationship with *GSDPG* within thresholds for LIG. *GS*3 has a positive significant effect on GSDPG in case of LIG, MIG, and HIG. ***, ** and * denotes the significance level at 1%, 5% and 10%, respectively. p-values are given in the parenthesis.

LIG		MIG		HIG	
Variables	Coefficients	Variables	Coefficients	Variable	Coefficients
*GS*1					
POPG	−0.58(0.53)	*POPG*	−0.51***(0.00)	…	…
EMPG	0.04*(0.06)	*EMPG*	0.01 (0.66)	…	…
GFCF	0.37 (0.38)	*GFCF*	−0.04(0.95)	…	…
PA	2.12(0.29)	*PA*	2.66**(0.04)	…	…
$GS1 < 5.16$	0.80(0.21)	$GS1 < 15.41$	0.24 (0.42)	…	…
$5.16 \leq GS1 \leq 5.31$	5.37***(0.00)	$15.41 \leq GS1 \leq 15.91$	0.03 (0.96)	…	…
$5..31 < GS1$	0.13(0.44)	$15.91 < GS1$	0.13 (0.42)	…	…
*GS*2				…	…
POPG	−0.75 (0.42)	…	…	…	…
EMPG	0.06***(0.01)	…	…	…	…
GFCF	0.43(0.29)	…	…	…	…
PA	0.66(0.34)	…	…	…	…
$GS2 \leq 0.80$	25.48***(0.00)	…	…	…	…
$0.80 \leq GS$	0.63 (0.12)	…	…	…	…
GS3					
POPG	−0.69(0.38)	*POPG*	−0.28***(0.00)	*POPG*	−0.36 (0.11)
EMPG	0.01(0.47)	*EMPG*	−0.004 (0.78)	*EMPG*	0.01 (0.79)
GFCF	0.40(0.26)	*GFCF*	0.29(0.58)	*GFCF*	0.16 (0.27)
PA	2.22(0.19)	*PA*	2.44**(0.02)	*PA*	0.25 (0.71)
$GS3 < 2.63$	0.71(0.52)	$GS3 < 3.43$	0.56(0.35)	$GS2 < 35.02$	−0.01*** (0.01)
$2.63 \leq GS3 \leq 2.42$	29.66***(0.00)	$3.43 \leq GS3 \leq 3.90$	10.49***(0.00)	$35.02 \leq GS3 \leq 95.79$	0.05***(0.00)
$2.42 < GS3$	−0.03(0.90)	$3.90 < GS3$	0.21 (0.36)	$95.79 < GS3$	0.04 0.41)

low-income group states, eastern and region states. There are also two significant thresholds of *GS*3 occur in the context of full panel, low, middle and high-income group states, and all the regions. The estimated threshold values are presented in Table 9.

Next, we examine the impact of the compositions of *GS* on *GSDPG* across full panel and sub-panels. Table 10 shows that within the estimated thresholds (i.e., 3.35% to 4.44%), *GS*1 has a positive impact on economic growth in case of full panel and low-income group states and eastern states. Below and above these estimated thresholds, the slope coefficients of *GS*1 decline and turns to insignificant. Moreover, 1%

Table 12
Regression estimate of single/double threshold model. LIG, MIG, and HIG stand for low-, middle-and high-income group states respectively. *GS*denotes the government size. *GS*1is government size based on the revenue. *GS*2 refers to the government size based on capital expenditure whereas *GS*3 is the government size based on the social sector expenditure. *POPG* and *EMPG* indicates the population and employment growth. *GFCF* is the gross fixed capital formation as a percentage to *GSDP*. *PA* is the political alignment. Results presented in this table show that *GS*1 has a positive effect on *GSDPG* in case of ER within the thresholds limit whereas in case of WR it doest has any effect. *GS*2positively associated with *GSDPG* in case of SR, and ER. *GS*3has a significant effect on *GSDPG* in case of SR, ER, and WR. ***, ** and * denotes the significance level at 1%, 5% and 10%, respectively. p-values are given in the parenthesis.

ER		WR		SR		NR	
Variables	Coefficients	Variables	Coefficients	Variables	Coefficients	Variables	Coefficients
*GS*1							
POPG	−0.26 (0.63)	*POPG*	−0.56 (0.18)	…	…	…	…
EMPG	0.02*(0.07)	*EMPG*	0.02 (0.44)	…	…	…	…
GFCF	0.31 (0.25)	*GFCF*	0.42 (0.41)	…	…	…	…
PA	−1.64 (0.14)	*PA*	4.40**(0.02)	…	…	…	…
$GS1 < 5.17$	−0.14 (0.71)	$GS1 < 4.19$	0.26 (0.79)	…	…	…	…
$5.17 \leq GS1 \leq 5.85$	3.95***(0.00)	$4.19 \leq GS1 \leq 4.30$	−1.40 (0.37)	…	…	…	…
$5.85 < GS1$	0.05 (0.29)	$4.30 < GS1$	−0.24 (0.25)	…	…	…	…
*GS*2							
POPG	−0.26 (0.63)	*POPG*	−0.50 (0.23)	*POPG*	−0.48***(0.00)	…	…
EMPG	0.02* (0.10)	*EMPG*	0.03 (0.23)	*EMPG*	0.01 (0.70)	…	…
GFCF	0.37 (0.17)	*GFCF*	0.22 (0.66)	*GFCF*	−0.16 (0.84)	…	…
PA	−1.09 (0.32)	*PA*	4.14**(0.02)	*PA*	3.21**(0.05)	…	…
$GS2 < 0.68$	−1.21 (0.18)	$GS2 < 0.77$	−2.82 (0.61)	$GS2 < 3.68$	0.843 (0.37)	…	…
$0.68 \leq GS2 \leq 0.80$	26.88***(0.00)	$0.77 \leq GS2 \leq 0.78$	−6.88 (0.56)	$3.68.54 \leq GS2 \leq 3.94$	0.54 (0.73)	…	…
$0.80 < GS2$	0.14 (0.26)	$0.78 < GS2$	−0.16 (0.79)	$3.94 < GS2$	1.72**(0.02)	…	…
*GS*3							
POPG	−0.40 (0.46)	*POPG*	−0.48 (0.91)	*POPG*	−0.36***(0.00)	*POPG*	−0.26 (0.56)
EMPG	0.02 (0.13)	*EMPG*	0.04* (0.07)	*EMPG*	−0.001 (0.94)	*EMPG*	−0.01 (0.52)
	0.38 (0.15)	*GFCF*	0.26 (0.55)	*GFCF*	0.38 (0.60)	*GFCF*	0.20 (0.19)
PA	−1.89 (0.08)	*PA*	4.45***(0.00)	*PA*	2.76 (0.05)	*PA*	0.73 (0.35)
$GS3 < 2.42$	−0.23 (0.77)	$GS3 < 1.95$	−0.49 (0.79)	$GS3 < 3.43$	0.47 (0.61)	$GS3 < 3.76$	−0.26 (0.62)
$2.42 \leq GS3 \leq 2.65$	10.13***(0.00)	$1.95 \leq GS3 \leq 2.01$	12.47***(0.00)	$3.43. \leq GS \leq 3.73$	7.04***(0.00)	$3.76 \leq GS3 \leq 4.27$	−0.62 (0.24)
$2.65 < GS3$	0.06 (0.46)	$2.01 < GS3$	0.03 (0.26)	$3.73 < GS3$	0.23 (0.58)	$4.27 < GS3$	−0.02 (0.89)

increase in *GS*1 leads to an increase of 2.30% in growth. Similar findings are noticed in case of *GS*2and *GS*3 in the majority of sub-panels based on income and regions (see, Tables 11 and 12). These findings show that within the estimated threshold, states governments are enjoying high economic growth.

Overall, our findings suggest that government size matter for economic growth at state level in India, but it is imperative for the state governments to keep the *GS* within the threshold level beyond which it may not effective in boosting the growth. In other words, our findings show that if state governments increase government size, which not only going to be less effective for economic growth, but it may threaten fiscal sustainability of these states in the long-run. Our findings are in the line of few studies based on countries (see for instances, Ram, 1986, 1989; Grossman, 1990; Ghali, 1998; Rubinson, 1977).

4. Conclusions

Though there is a wide range of literature on the relationship between government size and economic growth across the countries, the study on the link between optimum government size and economic growth at the sub-national level is scanty. To fill this research gap, the present study makes an attempt by examining the relationship between optimum government size and economic growth in the case of major Indian states using a panel thresholds regression for the period 1990-91 to 2017–18.

Our findings are summarized as follows: first, we find two significant thresholds in case of the aggregate panel and for the majority of the sub-panels. Second, for aggregate panel the results indicate that the government size has positive and significant effects on the economic growth particularly when government size lies between the lower and upper thresholds (i.e., 4.85% and 5.09%). However, once the government size moves above the upper limit of the threshold, the coefficient of the government size declined and turn to insignificant. This implies that Indian states may achieve higher economic growth if they maintain the government size between the estimated thresholds. Third, in the case of NSC and SC, the estimated thresholds are 4.55%–6.07% and 34.70%–38.55% respectively. Similarly, above these estimated thresholds, the relationship between *GS* and *GSDPG* become insignificant. The results also indicate that NSC states have smaller government size where SC states have larger government size. Our findings mostly consistent across the sub-panel based on the income and regions. Finally, we disaggregate the total government size into three main compositions based on revenue, capital, and social sector expenditures. Our findings, again consistent with the main finding, which indicates a positive and significant association between three compositions of government size and economic growth within the threshold limit for the majority of the panels.

From the policy perspective, state governments should minimize government expenditures by maintaining an ideal government size to attain fiscal sustainability and high and sustainable economic growth. Moreover, it is important for the Indian government to control expenditure or revenue efficiency to achieve an ideal government size. As mentioned in Kawai and Morgan (2013)study, preserving explicit fiscal rules to ensure agreement with budgetary discipline would be another way. Our results suggest that the Keynesian deficit spending to encourage economic growth does not necessarily have unfavorable consequences on growth as long as it maintains ideal government size.

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Appendix B. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.econmod.2019.09.015.

Appendix A1

A list of literature on optimum government size and economic growth.
Listed studies directly estimate the effect of optimum government size on economic growth.

Author	Samples	Country	Methodology	Proxies for government size	Optimum government size
Sheehey (1993)	1960-70-1970-80	120 countries	Panel Regression	Government consumption/GDP	15%
Hsieh and Lai (1994)	Different time periods (1950–87)	G-7	VAR	Total government expenditure	not found
Karras (1997)		European country	OLS and GLS	Government consumption,	16%
Chen and Lee (2005)	19979–2003	Taiwan	Hansen (1999, 2000) Threshold regression model	investment expenditure, consumption expenditure, total expenditure/gdp	Total expenditure threshold (22.83%), Investment (7.30%), Consumption (14.96%)
Chiou-Wei et al. (2010)	1961–2004	5 countries	Smooth transition autoregressive framework	per-capita government consumption expenditure	full (11%) and Taiwan (16%)
Witte and Moesen (2010)	1988–1999	23 OECD	Data envelopment analysis (DEA	average taxes; logarithm of total social expenditures	different optimum sizes
Christie (2014)	1971–2005	136 countries	Threshold regression model (Hansen, 1999, 2000)	total government expenditure/GDP	full (33%), developed (26%) and developing countries (33%)
Altunc and Aydin (2013)	1995–2011	Turkey, Romania and Bulgaria	ARDL bound testing approach	total share of public expenditure in GDP	both negative and positive effect
Asimakopoulos and Karavias (2016)	Unbalanced 1995–2014	129	Generalized Method threshold	government spending	full (18) developed (17.96) and developing (19.12%)

(continued on next column)

(continued)

Author	Samples	Country	Methodology	Proxies for government size	Optimum government size
Hajamini and Falahi (2018)		14 developed EU	Panel threshold method suggested by Hansen (1999)	consumption expenditure/GDP(FCE); current expenditure/GDP (CE) government gross fixed capital formation/ GDP (GFCF)	FEC and GFCF were estimated to be 16.63 and 2.31%, OCE always has a negative effect on economic growth

Appendix A2

Non-special category states (NSC)	Special category states (SC)
Andhra Pradesh, Bihar, Goa, Gujrat, Haryana, Karnataka, Kerala, Madhya Uttar Pradesh, Pradesh, Odisha, Punjab, Maharashtra, Rajasthan, Tamil Nadu, Uttar Pradesh, West Bengal	Arunachal Pradesh, Assam, Himachal Pradesh, Manipur, Meghalaya, Tripura
High-income group (HIG)	Middle-income group (MIG)
Goa, Gujrat, Haryana, Maharashtra, Tamil Nadu	Andhra Pradesh, Kerala, Karnataka, Punjab, West Bengal
Low-income group	
Rajasthan, Bihar, Madhya Pradesh, Odisha, Uttar Pradesh	
Geographical regions - Northern region	Southern region
Punjab, Uttar Pradesh, Rajasthan, Haryana, Himachal Pradesh	Andhra Pradesh, Tamil Nadu, Karnataka, Kerala
Western region	Eastern region
Goa, Gujarat, Maharashtra, Madhya Pradesh	Arunachal Pradesh, Assam, Manipur, Meghalaya, Tripura, Odisha, Bihar, West Bengal

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