Heliyon

ELSEVIER

Received:
20 December 2018
Revised:
13 February 2019
Accepted:
11 March 2019

Cite as: Nupur Nirola, Sohini Sahu. The interactive impact of government size and quality of institutions on economic growth- evidence from the states of India. Heliyon 5 (2019) e01352. doi: 10.1016/j.heliyon.2019.e01352

The interactive impact of government size and quality of institutions on economic growth- evidence from the states of India

Nupur Nirola, Sohini Sahu*

Department of Economic Sciences, Indian Institute of Technology Kanpur, Kanpur, India

* Corresponding author.

E-mail address: ssahu@iitk.ac.in (S. Sahu).

Abstract

This paper investigates the impact of government size on economic growth across 23 states in India between 2005 and 2014 for varying degrees of quality of institutions. Using pooled OLS, panel random effects estimation, as well as system-GMM estimation techniques, we find that in general, akin to findings in the literature, a bigger government is detrimental for state-level economic growth. However, the extent of the negative growth impact depends on the quality of institutions of the states, measured by a newly available index. States that have better quality of institutions register a lower negative impact on economic growth compared to their less progressive counterparts for similar increase in government size. Also, reduction in non-development government expenditure has a better growth impact compared to reduction in development government expenditure, especially for higher levels of institutional quality. Our results, that are robust to various specifications of government size, quality of institutions and estimation techniques, lead us to conclude that state governments should emphasize on quality of institutions to enhance state-level economic growth.

Keyword: Economics

https://doi.org/10.1016/j.heliyon.2019.e01352

1. Introduction

While most economists agree with the general statement that large governments are detrimental for economic growth, there is a consensus that even in a capitalist economy, governments act not just as regulators but also as providers of public services such as law and order, health and education, etc., thereby making their presence absolutely necessary. In the process, governments tend to absorb a sizeable share of the national output and thereby affect the economic growth of a country. The seminal work of Romer (1986), Lucas (1988), and Barro (1990), in their endogenous growth theory, pointed out the mechanisms by which the government sector can influence not only the level of output but also the steady-state level of output growth. Theoretically, they argued that government expenditure enters into the production function of the economy along with human and physical capital and effects the growth rate of the economy. According to them, public spending goes for public investment (infrastructures, schools, sanitation, etc.) and these public investments are further financed through income taxes, complement private investments. Since public investments raise the productivity of private investments, higher taxes can be associated with an increase or a decrease in overall growth.

Empirically, Barro (1991) found evidence supporting the existence of a negative growth effect from government consumption expenditure in a cross-sectional approach applied to a wide sample of developed countries over the period 1960-85. According to him, government consumption expenditure does not affect productivity but distorts private decisions leading to a lower steady-state level of output per effective labor and hence lower economic growth. Folster and Hernrekson (2001) studied the relationship on a sample of high-income countries over the period 1970−1995 and found a negative relationship between government expenditure and economic growth in these countries. The size of the estimated coefficients implied that an increase in the expenditure ratio by 10 percentage points is associated with a decrease in the growth rate by 0.7−0.8 percentage points. Wu et al. (2010) re-examined the causal relationship between government expenditure and economic growth by taking a richer panel data set of 182 countries that cover the period from 1950 to 2004 and found that the government plays a role in economic growth. Afonso and Furceri (2010) analyzed the effects in terms of size and volatility of government spending and revenue on economic growth in OECD and EU countries. They found both the variables to be detrimental for economic growth. In their later study, Afonso and Jalles (2014) studied the fiscal composition−growth nexus for a set of OECD countries and found no significant impact of revenues on growth whereas expenditures had negative effects. Angelopoulos and Philppopoulos (2008), Bergh and Karlsson (2010) studied the panel of rich OECD countries and found support for the negative relationship between government size and economic

https://doi.org/10.1016/j.heliyon.2019.e01352

growth. Most of these studies showed the negative impact of government size on economic growth among developed economies.

For less developed economies, an early study by Landau (1986) covering the period of 1960−1980 found the size of government to be negatively correlated with the growth of per capita GDP. Devarajan et al. (1996) studied the impact of different compositions of government expenditure on economic growth using data from 43 developing nations over 20 years. They found that an increase in the share of current expenditure has positive and statistically significant growth effects while the relationship between the capital component of public expenditure and per-capita growth is negative. Afonso and Jalles (2011) conducted an empirical analysis of 108 countries over the period of 1970−2008 that includes variables for government size and per capita economic growth. They found that there exists a negative relationship between government size and growth irrespective of the level of development of a country.

There are some relevant studies in the context of the Indian economy as well. Chandra (2004) studied this relationship for the Indian economy in a time-series framework and found that a large government size (in terms of investment and total expenditures) has a negative impact on growth in the short term although there is no long-term relationship between government size and GDP. Seshaiah et al. (2018) investigated the impact of government expenditure on GDP growth in India for the period 1980-81 to 2015-16. They found that post-2008 there was a negative and significant impact of general government expenditure on GDP growth rate. Shivaranjani (2010) studied the growth effects of government across fourteen major Indian states from 1980-81 to 2007-08 and concluded that while overall government size has a negative influence on per capita GSDP growth, increasing public expenditure on education, health, and economic infrastructure have significant positive growth effects, with the merit goods category (education and health) showing a higher effect than the other.

Overall, most studies found a negative effect of government size on economic growth due to higher inefficiencies, the excessive burden of taxation creating disincentives, crowding out effects, etc.

Although the size effect of the government (mostly) has negative growth impact, the literature gives evidence that the way governments function, which is governance or quality of governmental institutions, has a positive and significant impact on economic growth. The effect of governance or the role of government institutions, such as the rule of law and well-functioning property rights (Rodrik et al., 2004; Rodrik, 2008), in explaining long-run economic performance, has emerged from new institutional economics, pioneered by Douglass North (1989, 1991). Ever since, studies have focused on the quality of governance or the quality of public institutions and the possible interaction between government size and governance. There is now

https://doi.org/10.1016/j.heliyon.2019.e01352

evidence, as listed below, that although government size by itself might have negative growth effects, the effects are larger for economies or societies that also suffer from low quality of governance and vice versa.

Rajkumar and Swaroop (2008) examined the role of governance in the effectiveness of public spending in achieving social outcomes for a broad sample of 91 countries. They showed that the quality of governance could largely explain differences in the efficacy of public spending. Using data from 29 OECD countries between 1970 and 1995, they found that government size affects growth rate negatively. Also, they found some evidence that countries with a large public sector can use economic openness and market-oriented economic policies to mitigate the adverse effects of large government. Afonso and Jalles (2011) conducted an empirical analysis of 108 countries over the period of 1970−2008 that includes variables for government size and institutional quality (corruption perception index, the rule of law, civil liberty, polity measure, etc.). They found that the size of government has an adverse effect on economic growth while institutional quality has a positive impact. Bergh and Henrekson (2011) and Bergh and Bjornskov (2011) emphasized the case of Scandinavian countries where social trust positively affects both the government size and growth rate. Butkiewicz et al. (2011) studied the impact of different categories of government expenditures on economic growth, emphasizing how government effectiveness in developing nations influences the productivity of government spending for two time periods 1970−1999 and 1990−2004. They also took the Kaufmann et al. (2010) index of the rule of law controls for institutional quality. They concluded that consumption expenditures have negative growth effects in developed and developing nations, with a more detrimental impact in developing nations with ineffective governments. Mundle et al. (2012) studied the relationship between governance and output growth rate for the Indian economy at a disaggregated level for the time period 2004-05 to 2009-10. They measured the quality of governance using five parameters: political, legal-judicial, administrative, economic, and social-environmental and ranked the states accordingly. Further, they found a positive but statistically weak correlation between a state's governance quality and economic growth. Bhattacharjee (2016) followed the quality of governance indicators of Indian states by Mundle et al. (2012) to test the determinants of growth at state-level in the post-reform period. The study emphasized that even when government size and its associated institutions at the state level are controlled for, economic factors (like an investment) predominantly determine the growth of states. Certain governance indicators such as economic freedom and executive pillars have a significant impact on economic growth of states. Thus, most of the studies in the Indian context showed the detrimental impact of government size on economic growth, but the institutional quality of the public sector has had a positive impact on economic growth.

In this backdrop, our work combines the effects of government size, institutional quality, and the interaction between government size and institutional quality, on

https://doi.org/10.1016/j.heliyon.2019.e01352

economic growth across states in India. While there have been several studies on the effect of government and the effect of quality of institutions on economic growth in India, we could not locate any study that also looks into the interaction of these two variables on growth. Finding the impact of this interaction is essential since the effect of government expenditure on economic growth depends on the quality of institutions. It is worth mentioning that quality of institutions is a broad term and studies have focussed on either the quality of institutions, or quality of governance, or quality of the public sector, or the quality of bureaucracy, etc.

Angelopoulos and Philippopoulos (2008) looked at the relationship between fiscal size and economic growth while considering the impact of the efficiency of the public sector across a sample of 64 developed and developing countries between 1980 and 2000. They found "evidence of a non-monotonic relation between fiscal size and economic growth that depends critically on the size-efficiency mix". However, it may be noted that their estimated regression equation consisted of government size and an interaction term of government size and efficiency, and did not include a separate term on efficiency due to the problem of multicollinearity. However, as pointed out by Brambor et al. (2006), the inclusion of government size, quality and interaction between government size and quality does not lead to the problem of multicollinearity and hence the quality variable should not be dropped from the estimated equation. Oto-Peralías and Romero-Ávila (2013) studied a wide sample of developed and developing countries over the period 1981−2005. They found that government size reduces growth when bureaucracy quality is low, whereas no significant effect is observed for sufficiently high levels of bureaucracy quality. They also emphasized that the quality of public sector institutions influence the effect of government size on economic growth. Government size effects growth negatively when the quality of the public sector is low, but not necessarily so when public sector quality is high. Afonso and Jalles (2016) conducted a study on the effect of the public sector on economic output across different political and institutional measures covering 140 countries that included advanced, emerging and low-income countries between 1970 and 2010. They concluded that "the negative effect of government size on real GDP-per-capita is stronger at lower levels of institutional quality and the positive effect of institutional quality on GDP-per-capita is stronger at smaller levels of government size".

The novelty of our study in multi-fold. This is the first study, to the best of our knowledge, that explores the interaction between government expenditure and quality of institutions at the sub-national or state-level in India. Second, we employ a new dataset, namely the Social Progress Index (SPI), that incorporates institutional-quality related variables for the states of Indian between 2005 and 2016. Further, for robustness check, we use different kinds of government expenditure apart from the aggregate government expenditure. Estimation-wise too, apart from pooled OLS methodology and panel random effects model, we use system GMM to address

https://doi.org/10.1016/j.heliyon.2019.e01352

the issues related to endogeneity that might arise when we consider government expenditure and quality of institutions together in our equation. Our results indicate that in general, akin to findings in the literature, a bigger government is detrimental for state-level economic growth. However, the extent of the negative growth impact depends on the quality of institutions of the states. States that have a better quality of institutions register a lower negative impact on economic growth compared to their less progressive counterparts for a similar increase in government size. Also, the reduction in non-development government expenditure has a better growth impact compared to the reduction in development of government expenditure, especially for higher levels of institutional quality. Our results are robust to various specifications of government size, quality of institutions and estimation techniques.

The rest of the paper is organized as follows. Section 2 presents the relevant model, Section 3 discusses the materials (data) used for this study, while Section 4 presents the detailed methodology and results, and Section 5 concludes.

2. Model

The analytical framework for our work is provided by Afonso and Jalles (2016), which in turn is in line with Barro's (1990) seminal work on an endogenous growth model.

Afonso and Jalles (2016) set up an augmented Solow growth model that includes quality of governance, and after solving the optimization problem of the model, they obtain the following equation:

$$lny_{it} = A_0 + (1-\alpha-\beta)\mu_i t + (1-\alpha-\beta)\rho_i I_{it} + \alpha\, lnk_{it} + \beta\, lng_{it} \quad (1)$$

Eq. (1) describes the evolution of output per worker, as a function of a vector of institutional quality variables (I_{it}), the size of the government (g_{it}), the level of physical capital and human capital (splitting k_{it} into physical and human capital). This equation forms the basis of the empirical specification mentioned in the following section.

We have taken the linear as well as non-linear interaction model specifications of an augmented Solow growth model from Eq. (1) which is as follows:

$$growth_{it} = \alpha_i + \beta_1 income_{0i,t-1} + \beta_2 enrol_{i,t} + \beta_3 invest_{i,t} + \beta_4 govsize_{i,t} + \beta_4 institutional\ quality_{i,t} + \varepsilon_{i,t} \quad (2)$$

$$growth_{i,t} = \alpha_i + \beta_1 income_{0i,t-1} + \beta_2 enrol_{i,t} + \beta_3 invest_{i,t} + \beta_4 govsize_{i,t} + \beta_5 institutional\ quality_{i,t} + \beta_6 govsize{*}institutional\ quality_{i,t} + \varepsilon_{i,t} \quad (3)$$

https://doi.org/10.1016/j.heliyon.2019.e01352

where $growth_{i,t}$ is the real per capita state GDP growth rate, $income_{0i,t-1}$ is the initial per capita GDP (to control for convergence), $enrol_{i,t}$ represents secondary school gross enrolment ratio (proxy for human capital), $invest_{i,t}$ represents gross fixed capital formation (proxy for physical capital), $institutional\ quality_{i,t}$ represents quality of life in various states in terms of public services. Our interest lies in relating institutional quality to output measures i.e. how well states are performing in terms of social indicators that reflect the quality of public institutions, like education, health, crime, economic freedom etc. The coefficients of interest throughout this paper are β_4 and β_6, since are both necessary to calculate the marginal effects of government size on economic growth. It varies with quality measure i.e. how 1 unit change in government size affects economic growth if quality varies. Consequently, the marginal effect is given by:

$$\frac{\partial growth}{\partial govsize} = \beta_4 + \beta_6 Institutional\ Quality \tag{4}$$

where β_4 is the coefficient on government size and β_6 the coefficient on the interaction term.

It is also necessary to calculate the standard errors of the marginal effect, which is given by (Aiken et al., 1991):

$$\widehat{\sigma}_{\frac{\partial growth}{\partial govsize}} = \sqrt{var(\beta_4) + \ instituitional\ quality^2 \cdot var(\beta_6) + 2 \cdot instituitional\ quality \cdot cov(\beta_4 \cdot \beta_6)} \tag{5}$$

Thus, the effect of government size on economic growth depends on the quality of institutions and the impact varies across the spectrum that measures the quality of institutions.

3. Materials

We estimate a basic Solow growth model augmented with human capital, government size, public sector quality and the interaction of the latter two. Our analysis covers the years 2005-06 to 2013-14 and our sample comprises 23 states of India. These states are Andhra Pradesh, Assam, Bihar, Chhattisgarh, Goa, Gujarat, Haryana, Himachal Pradesh, Jammu & Kashmir, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Nagaland, Punjab, Rajasthan, Tamil Nadu, Tripura, Uttar Pradesh, Uttarakhand.

The choice of the sample period is guided by the availability of the Social Progress Index data (the one that we use to measure the quality of institutions) since it initiated from 2005-06.

https://doi.org/10.1016/j.heliyon.2019.e01352

As a first concern, we consider the total state-level government expenditure as a percentage of state GDP as a proxy for government size. The data is available from State Finances: A study of the Budget and the Reserve Bank of India. For robustness check, we also consider the components of government expenditure, i.e. developmental government expenditure and non-developmental government expenditure. As per the Finance Accounts of the State published by the Comptroller and Auditor General of India, all "Economic Services" (agricultural and allied activities, forestry and wildlife, transport etc.) as well as "Social Services" (education, public health, urban development etc.) come under development expenditure, while "General" services (interest payments against loans and advances, collection of taxes/duties, etc.) are a part of non-development expenditure. The classification is based on the criteria laid down by the Team of Reforms in the Structure of Budget & Accounts (Mukherjee Committee) in its report of 1972.

Data on the annual growth rate of per capita of gross state domestic product has been taken from the Handbook of Statistics on State Economy published by the Reserve Bank of India, for the concerned period and all data has been converted to 2004-05 prices. State-level gross enrolment ratio in secondary schools is taken as a proxy for human capital stock. The data has been taken from the Niti Ayog database published by U-DISE (Unified District Information System for Education). We have taken state-wise gross fixed capital formation for industries as a proxy for the physical capital stock from the Handbook of Statistics on State Economy published by the Reserve Bank of India, for the period mentioned above. State-wise per-capita growth rate and government size is presented in Fig. 1.

For institutional related measures, we rely on the Social Progress Index (2017) for the Indian states which is a new dataset introduced by the Insitute of Competitiveness, India, in collaboration with Harvard Business School. Social progress (2017) is defined as the "*capacity of a society to meet the basic human needs of its citizens, establish the building blocks that allow citizens and communities to enhance and sustain the quality of their lives, and create the conditions for all individuals to reach their full potential.*" The Social Progress Index does not consider the money spent on providing goods and services but measures the quality of people's lives. It is a policy index used to compare how well resources are being prioritized and mobilized across states of India. In the following sub-section, we elaborate as to why this index has been chosen as a proxy for the quality of institutions in the Indian context.

The descriptive statistics of all the variables mentioned in this section is available in Table 1.

3.1. Social Progress Index

In the literature, the quality of governance is measured by the well-known Kaufman "Worldwide Governance Indicators" published by the World Bank since 1996 for

https://doi.org/10.1016/j.heliyon.2019.e01352

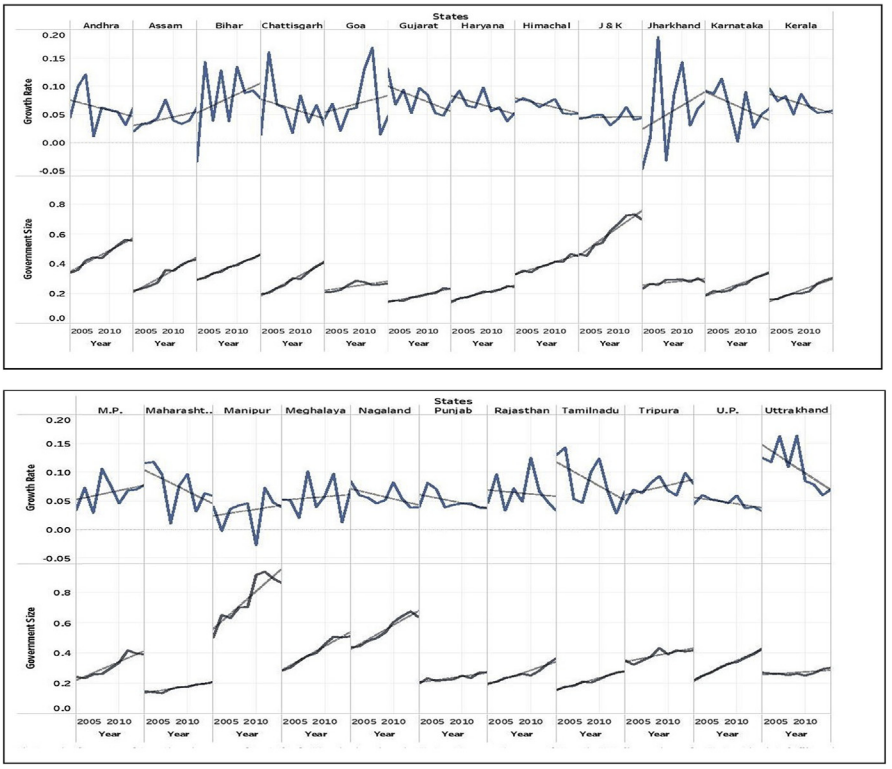

Fig. 1. The state-wise trend of per-capita economic growth and government size. Source: Author's calculation for each state between 2005 and 2014.

Table 1. Descriptive statistics of all the variables.

Variable	Obs	Mean	Standard deviation	Min	Max
Growth	207	0.063	0.035	−0.047	0.187
Government size (Total Exp %GDP)	207	0.336	0.154	0.134	0.93
Government size (Dev Exp %GDP)	207	0.206	0.097	0.070	0.595
Government size (Non-Dev Exp %GDP)	207	0.159	0.070	0.060	0.408
Investment ratio	207	0.051	0.043	0.000	0.205
Gross enrolment ratio	207	0.531	0.190	0.128	1.315
Social Progress Index	207	6.52	2.72	1	11

Note: Authors' calculation.

212 countries. It captures six key dimensions of governance (Voice & Accountability, Political Stability and Lack of Violence, Government Effectiveness, Rule of Law, and Control of Corruption).

In India, attempts have been made to capture the quality of governance by Mundle et al. (2012, 2016). They have measured the performance of the seventeen states of India regarding better governance via their index. It is based on three main pillars:

https://doi.org/10.1016/j.heliyon.2019.e01352

the executive, the judiciary, and the legislature. Overall, their index is based on six dimensions namely the infrastructure service delivery, social service delivery, fiscal performance of states, law, and order, judicial service delivery and quality of the legislature.

The Public Affairs Centre publishes the Public Affairs Index in India (Mathew et al., 2016, 2017, 2018). They have ranked the states according to ten main dimensions (infrastructure, human development, social protection, women and children, law and order, delivery of justice, environment, transparency and accountability, fiscal management and economic freedom).

However, we have not used the above indices at the state level for the reasons cited below. First, the Social Progress Index (2017) does not aim at measuring the efficiency of governance in terms of inputs. Input indices look at regional policies that are believed to lead to an outcome (such as government expenditure in various sectors); output indices on the other hand directly measure the outcomes of those policies. The Social Progress Index takes into account the citizen's experience directly. For instance, the Social Progress Index does not measure *how* much money has been spent on education or healthcare but measures the *actual* educational attainment and the length and quality of people's lives. It is a development indicator that indicates the quality of institutions. Second, the Social Progress Index is available from 2005 to 2016, while Mundle et al.'s index is available for fewer years between 2004-05 and 2009-10, and so is that for the Public Affairs Index which is available for 2016, 2017 and 2018. Third, the aim of our study is not to test the impact of government efficiency on economic growth but to see how government size affects the growth rate as states progress on the scale of the index.

Although there is no established measure for institutional quality in India as of present, we consider the Social Progress Index as a proxy for the same since it includes dimensions (detailed below) that reflect the quality of institutions in an economy.

The broad dimensions defining the Social Progress Index are:

1. Basic Human Needs Dimension: takes into account population to survive with adequate nourishment and primary health care, clean water and sanitation, adequate shelter, and personal safety.
2. Foundations of Wellbeing: considers whether a society offers building blocks for citizens to improve their lives, such as getting a primary education, obtaining information, and access communications, benefiting from a modern healthcare system and live in a healthy environment.
3. Opportunity: captures whether citizens have the opportunity to make their own choices. This includes personal rights, personal freedom, and choice, tolerance. Also, includes inclusion, and access to advanced education.

https://doi.org/10.1016/j.heliyon.2019.e01352

The Social Progress Index uses the Principal Component Analysis (PCA) for calculating the weights of indicators within a component. The component values are calculated by summing the weighted scores using the following formula.

$$\text{Components} = \sum(\text{wi}^*\text{indicator}) \quad (6)$$

The component scores in Eq. (6) are valued on a scale of 0−100. This is done by calculating scores using the best and worst-case scenario in addition to the regional dataset.

Each dimension score is taken to be a simple average of its four components (Eq. (7)).

$$\text{Dimension}_d = 1/4\ \Sigma\ \text{Components} \quad (7)$$

The three dimensions are assumed to reflect equally important aspects of the quality of life. Therefore, while calculating the index, equal weights are assigned to each of them to highlight their role in social progress (Eq. (8)).

$$\text{SPI} = 1/3\ \Sigma\ \text{Dimension}_d \quad (8)$$

In the absence of any comprehensive measure of the quality of institutions at the state level in India, we consider the Social Progress Index as a proxy for the same since it consists of the dimensions that reflect institutional quality. As a robustness check, out of all the components mentioned above in Table 1, we segregate five components that come closest to the indicators of good governance based on the World Governance Indicator. We call this sub-set, consisting of Personal Rights, Choice, Personal Safety and Inclusion, the governance proxy. Finally, we rescale the index on a scale size of 1−11 to calculate the marginal effects around the standard deviation of the government size variable (following Barro, 1991).

We observe from Figs. 2 and 3 that the states belonging to the upper hierarchy are the high-income states and low-income states are lying on the lower hierarchy. The values have been calculated by taking an overall average of the Index over the time of 2005−2013. The highest social progress has been in those areas having high economic prosperity in income whereas the areas where performance has declined are those where correlation is weak.

High-income states are performing better in terms of performance and society's experience in terms of quality of life, but government size in these states is lower than states with low-income. It simply means that the government is not spending too much in high-income states still they are performing better in terms of education and healthcare, infrastructure, crime, etc. That is they are achieving high governance with less government.

https://doi.org/10.1016/j.heliyon.2019.e01352

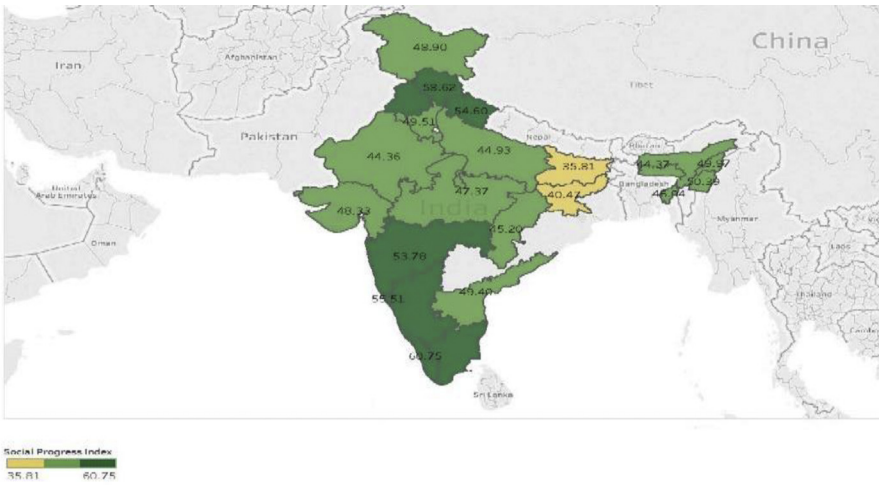

Fig. 2. Social Progress Index for the States of India. Source: Author's calculation using SPI data for each state between 2005 and 2014. For details see https://socialprogress.in/spi-states-of-india-2017/.

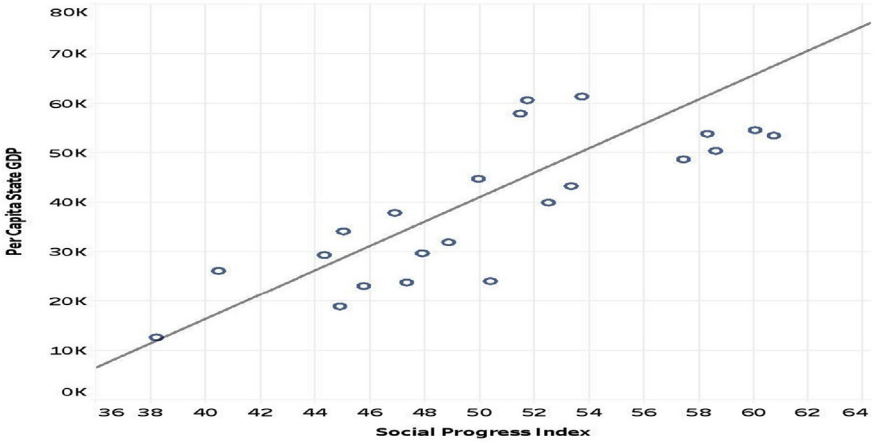

Fig. 3. Correlation between Per capita GDP and Social Progress Index Scores. Source: Authors' calculation.

Having given a detail of the data used in the study, we now proceed to the estimation methodology and the corresponding results.

4. Results and discussion

We estimate Eqs. (2) and (3) following the pooled OLS technique, the panel data technique (fixed effects or random effects), and the panel data technique while considering endogeneity concerns (dynamic panel).

To reflect the quality of institutions, we consider different variants of the same in each estimation. These are – (i) the Social Progress Index (SPI)- indicating the quality of institutions (columns 1 and 2), (ii) Governance proxy, which is a sub-set of the

https://doi.org/10.1016/j.heliyon.2019.e01352

Social Progress Index (columns 3 and 4), and (iii) individual components that reflect governance like- Personal Rights (columns 5 and 6), Choice (column 7 and 8), Personal Safety (columns 9 and 10) and Inclusion (columns 11 and 12). The detailed description of all the variables has been described in the previous section.

Table 2 presents our the baseline results for the different specifications of institutional quality (six in total) using pooled OLS technique. We use total government expenditure as a percentage of gross real domestic product (a proxy for government size) and discuss its individual inclusion in estimated regressions besides its interaction with different quality variables (defined as I_{it}).

In Table 2, for columns 1−4, we have excluded human capital because SPI and governance indicators already include gross enrolment ratio at the secondary level. We find a statistically significant negative coefficient on the government size proxy in all six specifications (with as well as without interaction).

In Table 2, the coefficient of government expenditure is statistically significant across all specifications of the quality of institutions. The coefficient varies between −0.04 and −0.07 indicating that an increase in government size by 10% points, is associated with 0.7%−0.4% lower growth in per capita state GDP. This order of magnitude is consistent with the previous literature. Institutional quality has a positive but insignificant impact on economic growth. The physical capital as well as human capital showing the positive but insignificant impact on economic growth.

It is to be noted that although the coefficient of the quality of institutions is positive, it is statistically not significant across different specifications. This implies that the quality of institutions by itself cannot lead to economic growth.

Our main variable of interest is the interaction term. The interaction term in Table 2 is negative and significant in columns 2, 4, 8 and 10. This indicates that the effect of government expenditure is negative on economic growth when institutional quality is zero. To assess the effect of different levels of quality of institutions, we need to calculate the marginal effect of government size at different levels of institutional quality following Eq. (4) and their standard errors following Eq. (5).

The results of the marginal effect are presented in Table 3. Each column represents the six proxies for the institutional quality index. Each row defines the marginal effect of an increase in per capita output (GDP) growth due to change in per capita government expenditure (aggregate), given the level of institutional quality. In columns 1−6, the marginal effects are consistently negative and significant for all given values of the quality index. When the institutional quality is 1, then the marginal effect is −0.047, which implies that for 10% decrease in government expenditure, per-capita growth would increase by 0.4%. The same increase is 0.78% (for an equivalent 10% fall in government expenditure) when the quality of institutions is better i.e. it is 2. For an even higher quality of institutions that is equal to 3, this growth effect is still

https://doi.org/10.1016/j.heliyon.2019.e01352

Table 2. Baseline results, full sample: Pooled OLS estimation with interaction terms (Considering aggregate government expenditure).

Spec: Institutional proxy	Social Progress Index		Governance index		Personal rights	
	1	2	3	4	5	6
ln (Initial per capita GDP)	−0.006 (0.008)	−0.005 (0.008)	−0.005 (0.008)	−0.008 (0.008)	−0.005 (0.007)	−0.002 (0.007)
Government size	−0.052*** (0.017)	−0.047* (0.016)	−0.045*** (0.018)	−0.067*** (0.016)	−0.054*** (0.016)	−0.056*** (0.015)
Physical capital	0.051 (0.060)	0.103 (0.062)	0.044 (0.073)	0.094 (0.074)	0.061 (0.078)	0.061 (0.079)
Human capital	-	-	-	-	0.012 (0.015)	0.0115 (0.015)
Quality index	0.002 (0.001)	0.002 (0.003)	0.002 (0.002)	0.0013 (0.0016)	−0.001 ((0.001)	−0.002 ((0.001)
Government size * quality index	-	−0.036*** (0.011)	-	−0.024*** (0.008)	-	−0.002 (0.004)
Constant	0.130 (0.084)	0.107 (0.083)	0.116 (0.090)	0.139 (0.089)	0.056 (0.070)	0.057 (0.071)
Observations	207	207	207	207	207	207
R-squared	0.076	0.110	0.076	0.113	0.076	0.076

Spec: Institutional proxy	Choice		Personal safety		Inclusion	
	7	8	9	10	11	12
ln (Initial per capita GDP)	−0.007 (0.008)	−0.002 (0.008)	−0.0014 (0.007)	−0.0013 (0.007)	−0.002 (0.006)	−0.006 (0.007)
Government size	−0.053*** (0.016)	−0.048 (0.017)	−0.0472*** (0.0158)	−0.0471 (0.0149)	−0.051*** (0.017)	−0.066*** (0.021)
Physical capital	0.0511 (0.077)	0.058 (0.078)	0.0455 (0.079)	0.0454 (0.079)	0.0502 (0.077)	0.0811 (0.0834)
Human capital	0.010 (0.016)	0.0105 (0.016)	0.0845 (0.015)	0.0084 (0.015)	0.007 (0.016)	0.008 (0.016)
Quality index	0.003 (0.002)	−0.007 (0.002)	−0.009 (0.001)	−0.009 (0.001)	0.0077 (0.0012)	−0.007 (0.0012)
Government size * quality index	-	−0.006 (0.009)	-	−0.001 (0.002)	-	−0.0124* (0.007)
Constant	0.091 (0.101)	0.071 (0.081)	0.0597 (0.070)	0.086 (0.073)	0.076 (0.069)	0.108 (0.080)
Observations	207	207	207	207	207	207
R-squared	0.070	0.073	0.073	0.073	0.072	0.081

Note: The models are estimated by Pooled OLS. The dependent variable is the growth of real GDP per capita. Total Government Expenditure as a percentage of GDP proxy for Government Size. Robust homoscedastic standard errors are reported in parenthesis below each coefficient estimate. *, **, *** denote significance at 10%, 5% and 1 % levels respectively.

https://doi.org/10.1016/j.heliyon.2019.e01352

Table 3. Marginal effects of government size on growth depending upon the quality (Considering aggregate government expenditure).

	1	2	3	4	5	6
Quality = 1	−0.047*** (0.017)	−0.067*** (0.018)	−0.056*** (0.018)	−0.048*** (0.018)	−0.047*** (0.020)	−0.067*** (0.022)
Quality = 2	−0.078*** (0.019)	−0.092*** (0.023)	−0.057*** (0.026)	−0.054*** (0.017)	−0.047*** (0.022)	−0.080*** (0.028)
Quality = 3	−0.108*** (0.027)	−0.115*** (0.029)	−0.059*** (0.023)	−0.060*** (0.020)	−0.046*** (0.026)	−0.092*** (0.035)
Quality = 4	−0.139** * (0.036)	−0.140*** (0.036)	−0.061*** (0.027)	−0.066** (0.025)	−0.046*** (0.030)	−0.105*** (0.043)

Note: Total expenditure as a % of GDP have been taken as a proxy for government size. The standard deviation of the Quality Index has been taken. Robust homoscedastic standard errors are reported in parenthesis below each coefficient estimate. *, **, *** denote significance at 10%, 5% and 1 % levels respectively.

negative as before, but the negative impact is smaller compared to lower levels of institutional quality. Now, for a 10% decrease in aggregate government expenditure, per-capita growth increases by 1.08%. Moreover, this is also true when the quality of institutions is 4 and so on. Thus, as the quality of institutions improves, each 10% decline in aggregate government expenditure is accompanied by a higher positive impact on economic growth. Or, to rephrase the findings, states that have better quality of institutions register a lower negative impact on economic growth compared to their less progressive counterparts for a similar increase in government size.

Similar conclusions are drawn when panel random effects estimates are conducted, and the results are reported in Table 4 (the Hausman test regarding the choice of panel model favors random effects against fixed effects model).

Our findings are in line with Afonso and Jalles (2016) who found a negative impact of government size on economic growth, a positive impact of various specifications of quality of institutions and a negative interaction term, across 140 countries over 40 years.

4.1. Institutions and growth: does the composition of government expenditure matter?

Our analysis above was based on aggregate government expenditure. In order to check if our results are robust to the choice of government expenditure, we consider the composition of government expenditure i.e. developmental government expenditure and non-developmental government expenditure, both as a percentage of GDP.

Table 5 presents the results of pooled OLS when development government expenditure is considered, and Table 6 presents the pooled OLS results for non-development government expenditure. Tables 7 and 8 are the random effects

https://doi.org/10.1016/j.heliyon.2019.e01352

Table 4. Baseline results, full sample: Random Effect estimation with interaction terms (Considering aggregate government expenditure).

Spec: Institutional proxy	**Social Progress Index**		**Governance index**		**Personal Rights**	
	1	**2**	**3**	**4**	**5**	**6**
ln (Initial per capita GDP)	−0.006 (0.009)	−0.004 (0.009)	−0.004 (0.0086)	−0.008 (0.008)	0.0003 (0.0073)	0.0007 (0.00753)
Government size	−0.052*** (0.0189)	−0.050*** (0.0182)	−0.047** (0.0195)	−0.072*** (0.0214)	−0.055*** (0.0199)	−0.059*** (0.0212)
Physical capital	0.040 (0.066)	0.088 (0.066)	0.035 (0.0668)	0.082 (0.0688)	0.0386 (0.0692)	0.0488 (0.0670)
Human capital	-	-	-	-	0.00902 (0.0169)	0.00848 (0.0170)
Quality index	0.0017 (0.002)	0.0002 (0.002)	0.0016 (0.001)	0.0011 (0.002)	−0.0012 (0.001)	−0.0012 (0.0010)
Government size * quality index	-	−0.0311*** (0.0115)	-	−0.0276*** (0.0089)	-	−0.0034 (0.00567)
Constant	0.123 (0.097)	0.105 (0.092)	0.108 (0.088)	0.137 (0.090)	0.062 (0.084)	0.068 (0.080)
Observations	207	207	207	207	207	207
R-squared	23	23	23	23	23	23

Spec: Institutional proxy	**Choice**		**Personal safety**		**Inclusion**	
	7	8	9	10	11	12
ln (Initial per capita GDP)	−0.0003 (0.0084)	−0.0012 (0.0079)	−0.0005 (0.00729)	−0.0004 (0.00753)	−0.0010 (0.00759)	−0.0049 (0.00821)
Government size	−0.054** (0.019)	−0.0502** (0.0202)	−0.050** (0.0211)	−0.0507** (0.0223)	−0.049** (0.0208)	−0.0692*** (0.0255)
Physical capital	0.0386 (0.0692)	0.0488 (0.0670)	0.0363 (0.0683)	0.0353 (0.0694)	0.0360 (0.0692)	0.0663 (0.0735)
Human capital	0.0062 (0.0176)	0.008 (0.0171)	0.0064 (0.0166)	0.00616 (0.0169)	0.00324 (0.0174)	0.0041 (0.0176)
Quality index	0.00021 (0.00149)	0.0007 (0.0014)	0.0006 (0.00131)	0.0006 (0.00135)	0.0011 (0.00147)	0.0011 (0.00149)
Government size * quality index	-	−0.00444 (0.00904)	-	−0.000342 (0.00654)	-	−0.0137 (0.00987)
Constant	0.0626 (0.0847)	0.0686 (0.0801)	0.0636 (0.0713)	0.0631 (0.0736)	0.0707 (0.0748)	0.107 (0.0804)
Observations	207	207	207	207	207	207
R-squared	23	23	23	23	23	23

Note: The dependent variable is the growth of real GDP per capita. Total Government Expenditure as a percentage of GDP proxy for Government Size. Robust homoscedastic standard errors are reported in parenthesis below each coefficient estimate. *, **, *** denote significance at 10%, 5% and 1 % levels respectively.

https://doi.org/10.1016/j.heliyon.2019.e01352

Table 5. Baseline results, full sample: Pooled OLS estimation with interaction terms (Considering development government expenditure).

Spec: Institutional proxy	Social Progress Index		Governance index		Personal rights	
	1	2	3	4	5	6
ln (Initial per capita GDP)	−0.005 (0.008)	−0.002 (0.008)	−0.005 (0.008)	−0.006 (0.007)	−0.009 (0.006)	−0.007 (0.006)
Government size	−0.0768*** (0.026)	−0.068 (0.026)	−0.069*** (0.027)	−0.093*** (0.028)	−0.082*** (0.026)	−0.085*** (0.028)
Physical capital	0.0688 (0.059)	0.115* (0.062)	0.061 (0.060)	0.113* (0.062)	0.0789 (0.061)	0.080 (0.061)
Human capital	-	-	-	-	0.0092 (0.015)	0.008 (0.015)
Quality index	0.0015 (0.001)	−0.0026 (0.001)	0.0016 (0.002)	0.0010 (0.0014)	−0.001 (0.001)	−0.001 (0.001)
Govt size * quality	-	−0.0387*** (0.016)	-	−0.033*** (0.013)	-	−0.0029 (0.0082)
Constant	0.114 (0.084)	0.0791 (0.084)	0.110 (0.077)	0.117 (0.076)	0.055 (0.060)	0.054 (0.060)
Observations	207	207	207	207	207	207
R-squared	0.073	0.098	0.074	0.104	0.070	0.075

Spec: Institutional proxy	Choice		Personal safety		Inclusion	
	7	8	9	10	11	12
ln (Initial per capita GDP)	−0.003 (0.007)	−0.003 (0.007)	−0.0084 (0.0063)	−0.007 (0.006)	−0.0013 (0.006)	−0.004 (0.006)
Government size	−0.0805*** (0.027)	−0.0735** (0.029)	−0.0711*** (0.0301)	−0.0705 (0.0321)	−0.0755*** (0.027)	−0.096*** (0.032)
Physical capital	0.0669 (0.0611)	0.0729 (0.062)	0.0624 (0.061)	0.0621 (0.061)	0.0656 (0.060)	0.100 (0.066)
Human capital	0.0084 (0.016)	0.0085 (0.016)	0.0061 (0.015)	0.0061 (0.015)	0.004 (0.015)	0.0018 (0.015)
Quality index	−0.002 (0.002)	−0.003 (0.002)	−0.008 (0.001)	−0.008 (0.001)	0.0011 (0.0012)	−0.0014 (0.0012)
Govt size * quality	-	−0.0078 (0.013)	-	−0.005 (0.009)	-	−0.0191 (0.014)
Constant	0.052 (0.072)	0.055 (0.072)	0.0659 (0.061)	0.0655 (0.062)	0.0720 (0.062)	0.094 (0.065)
Observations	207	207	207	207	207	207
R-squared	0.069	0.070	0.073	0.073	0.072	0.079

Note: The dependent variable is the growth of real GDP per capita. Total Development Government Expenditure as a percentage of GDP proxy for Government Size. Robust homoscedastic standard errors are reported in parenthesis below each coefficient estimate. *, **, *** denote significance at 10%, 5% and 1 % levels respectively.

https://doi.org/10.1016/j.heliyon.2019.e01352

Table 6. Baseline results, full sample: Pooled OLS estimation with interaction terms (Considering non-development government expenditure).

Spec: Institutional proxy	Social Progress Index		Governance index		Personal rights	
	1	2	3	4	5	6
ln (Initial per capita GDP)	−0.004 (0.008)	−0.002 (0.008)	−0.004 (0.007)	−0.005 (0.007)	−0.001 (0.006)	−0.005 (0.006)
Government size	−0.110*** (0.036)	0.108* (0.062)	−0.101*** (0.038)	−0.125*** (0.038)	−0.119*** (0.036)	−0.122*** (0.037)
Physical capital	0.0719 (0.058)	−0.108 (0.035)	0.064 (0.059)	0.109* (0.062)	0.0807 (0.060)	0.082 (0.061)
Human capital	-	-	-	-	0.0107 (0.015)	0.0106 (0.015)
Quality index	0.0014 (0.002)	−0.003 (0.001)	0.0015 (0.0014)	0.0011 (0.0014)	−0.001 (0.001)	−0.002 (0.001)
Govt size * quality	-	−0.048*** (0.020)	-	−0.0417*** (0.016)	-	−0.0042 (0.011)
Constant	0.106 (0.084)	0.0755 (0.0836)	0.102 (0.077)	0.107 (0.076)		0.054 (0.060)
Observations	207	207	207	207	207	207
R-squared	0.077	0.102	0.077	0.106	0.080	0.081

Spec: Institutional proxy	Choice		Personal safety		Inclusion	
	7	8	9	10	11	12
ln (Initial per capita GDP)	−0.007 (0.007)	−0.003 (0.007)	−0.0084 (0.0063)	−0.007 (0.006)	−0.0013 (0.006)	−0.004 (0.006)
Government size	−0.117*** (0.036)	−0.109** (0.038)	−0.105*** (0.042)	−0.104 (0.0415)	−0.0755*** (0.027)	−0.096*** (0.032)
Physical capital	0.0675 (0.061)	0.0729 (0.062)	0.0644 (0.061)	0.0635 (0.061)	0.0656 (0.060)	0.100 (0.066)
Human capital	0.0105 (0.016)	0.0109 (0.016)	0.0076 (0.015)	0.0075 (0.015)	0.004 (0.015)	0.0018 (0.015)
Govt size * quality	−0.003 (0.001)	−0.004 (0.001)	−0.008 (0.001)	0.007 (0.001)	0.0011 (0.0012)	−0.0014 (0.0012)
Interaction	-	−0.0126 (0.017)	-	0.002 (0.013)	-	−0.0191 (0.014)
Constant	0.0476 (0.071)	0.0541 (0.072)		0.0638 (0.061)	0.0720 (0.062)	0.094 (0.065)
Observations	207	207	207	207	207	207
R-squared	0.074	0.077	0.075	0.076	0.072	0.079

Note: The dependent variable is the growth of real GDP per capita. Total Non-Development Government Expenditure as a percentage of GDP proxy for Government Size. Robust homoscedastic standard errors are reported in parenthesis below each coefficient estimate. *, **, *** denote significance at 10%, 5% and 1 % levels respectively.

https://doi.org/10.1016/j.heliyon.2019.e01352

Table 7. Baseline results, full sample: Random effect estimation with interaction terms (Considering development government expenditure).

Spec: Institutional proxy	Social Progress Index		Governance index		Personal rights	
	1	2	3	4	5	6
ln (Initial per capita GDP)	−0.0045 (0.00958)	−0.0017 (0.00961)	−0.0039 (0.00872)	−0.0056 (0.00902)	0.00079 (0.00742)	0.00114 (0.00756)
Government size	−0.0796*** (0.0299)	−0.0750** (0.0298)	−0.0726** (0.0312)	−0.104*** (0.0336)	−0.0857*** (0.0311)	−0.0914*** (0.0326)
Physical capital	0.0542 (0.0658)	0.0936 (0.0675)	0.0487 (0.0664)	0.0989 (0.0699)	0.0642 (0.0688)	0.0647 (0.0697)
Human capital	-	-	-	-	0.00639 (0.0168)	0.00597 (0.0170)
Quality index	0.00138 (0.00164)	−0.00019 (0.00176)	0.00147 (0.00162)	0.000786 (0.00167)	−0.00125 (0.00103)	−0.00129 (0.00105)
Government size * quality index	-	−0.0413** (0.0171)	-	−0.0402*** (0.0139)	-	−0.00600 (0.00919)
Constant	0.107 (0.0983)	0.0736 (0.0989)	0.102 (0.0897)	0.112 (0.0926)	0.0489 (0.0725)	0.0453 (0.0739)
Observations	207	207	207	207	207	207
R-squared	23	23	23	23	23	23

Spec: Institutional proxy	Choice		Personal safety		Inclusion	
	7	8	9	10	11	12
ln (Initial per capita GDP)	0.00073 (0.00842)	0.000368 (0.00826)	0.000109 (0.00733)	0.000132 (0.00754)	−0.00098 (0.00766)	−0.00357 (0.00807)
Government size	−0.0828*** (0.0309)	−0.0779** (0.0324)	−0.0773** (0.0336)	−0.0785** (0.0359)	−0.0759** (0.0320)	−0.0992*** (0.0369)
Physical capital	0.0531 (0.0682)	0.0588 (0.0678)	0.0519 (0.0676)	0.0512 (0.0687)	0.0486 (0.0684)	0.0831 (0.0746)
Human capital	0.0044 (0.0175)	0.0048 (0.0174)	0.00395 (0.0165)	0.0038 (0.0167)	0.00023 (0.0172)	−0.00243 (0.0175)
Quality index	−0.0003 (0.0015)	−0.0001 (0.00149)	0.0005 (0.00135)	0.00047 (0.00138)	0.00135 (0.00146)	0.00154 (0.00149)
Government size * quality index	-	−0.0055 (0.0139)	-	−0.0006 (0.0102)	-	−0.0216 (0.0162)
Constant	0.0512 (0.084)	0.0541 (0.082)	0.0578 (0.072)	0.0577 (0.0737)	0.0712 (0.0756)	0.0960 (0.0795)
Observations	207	207	207	207	207	207
R-squared	23	23	23	23	23	23

Note: The models are estimated by Pooled OLS. The dependent variable is the growth of real GDP per capita. Total Development Government Expenditure as a percentage of GDP proxy for Government Size. Robust homoscedastic standard errors are reported in parenthesis below each coefficient estimate. *, **, *** denote significance at 10%, 5% and 1 % levels respectively.

https://doi.org/10.1016/j.heliyon.2019.e01352

Table 8. Baseline results, full sample: Random Effect estimation with interaction terms (Considering non-development government expenditure).

Spec: Institutional proxy	Social Progress Index		Governance index		Personal rights	
	1	2	3	4	5	6
ln (Initial per capita GDP)	−0.0036 (0.0095)	−0.0012 (0.0094)	−0.0031 (0.0087)	−0.0043 (0.00894)	0.0006 (0.0073)	0.0009 (0.0075)
Government size	−0.112*** (0.0397)	−0.116*** (0.0394)	−0.104** (0.0417)	−0.137*** (0.0438)	−0.122*** (0.0413)	−0.128*** (0.0426)
Physical capital	0.0593 (0.0651)	0.0899 (0.0658)	0.0539 (0.0659)	0.0959 (0.0685)	0.0678 (0.0681)	0.0690 (0.0690)
Human capital	-	-	-	-	0.0087 (0.0168)	0.0085 (0.0170)
Quality index	0.0012 (0.0016)	−0.0001 (0.0017)	0.00131 (0.00162)	0.0008 (0.0016)	−0.0012 (0.0010)	−0.0013 (0.0010)
Government size * quality index	-	−0.0510** (0.0213)	-	−0.0485*** (0.0176)	-	−0.0080 (0.0120)
Constant	0.0983 (0.0973)	0.0691 (0.0974)	0.0928 (0.0894)	0.1000 (0.0917)	0.0491 (0.0716)	0.0455 (0.0730)
Observations	207	207	207	207	207	207
R-squared	23	23	23	23	23	23

Spec: Institutional proxy	Choice		Personal safety		Inclusion	
	7	8	9	10	11	12
ln (Initial per capita GDP)	0.00084 (0.00831)	0.00024 (0.00801)	0.0003 (0.00729)	0.00012 (0.00746)	−0.0010 (0.00758)	−0.0031 (0.00792)
Government size	−0.118*** (0.0410)	−0.112*** (0.0411)	−0.112** (0.0447)	−0.112** (0.0458)	−0.109** (0.0425)	−0.136*** (0.0473)
Physical capital	0.0561 (0.0674)	0.0631 (0.0658)	0.0550 (0.0671)	0.0541 (0.0681)	0.0519 (0.0676)	0.0855 (0.0732)
Human capital	0.00706 (0.0176)	0.00810 (0.0172)	0.00610 (0.0166)	0.00595 (0.0168)	0.00262 (0.0173)	0.00039 (0.0175)
Quality index	−0.00014 (0.00149)	−0.00027 (0.00146)	0.00041 (0.00134)	0.000381 (0.00138)	0.00125 (0.00145)	0.00152 (0.00149)
Government size * quality index	-	−0.00961 (0.0177)	-	0.000142 (0.0150)	-	−0.0281 (0.0198)
Constant	0.0484 (0.0833)	0.0534 (0.0802)	0.0573 (0.0713)	0.0565 (0.0728)	0.0701 (0.0748)	0.0901 (0.0779)
Observations	207	207	207	207	207	207
R-squared	23	23	23	23	23	23

Note: The models are estimated by Pooled OLS. The dependent variable is the growth of real GDP per capita. Total Non-Development Government Expenditure as a percentage of GDP proxy for Government Size. Robust homoscedastic standard errors are reported in parenthesis below each coefficient estimate. *, **, *** denote significance at 10%, 5% and 1 % levels respectively.

https://doi.org/10.1016/j.heliyon.2019.e01352

estimates of development expenditure and non-development government expenditures respectively. As before, various specifications of quality of institutions have been considered.

The overall conclusions based on Tables 5 and 6 are similar to the findings based on Table 2. However, when we consider the composition of government expenditure, although the growth effect is still negative as before, the magnitude changes. Say, when we consider columns 1 and 2 of Tables 5 and 6, we find that 10% fall in development government expenditure increases economic growth by 0.8%, whereas the same fall in non-development government expenditure increases economic growth by 1.1%.

The coefficient of the interaction term in column 2 in Table 5 indicates that when the quality of institutions is zero, then for a 10% fall in development government expenditure, growth increases by around 0.39%. Whereas, column 2 in Table 6 indicates that when the quality of institutions is zero, then for a 10% fall in non-development government expenditure, growth increases by around 0.48%. Similar findings are observed for other specifications of the quality of institutions.

Similar conclusions can be drawn when we estimate the same relationship using random effects in Tables 7 and 8.

If we look at the marginal effects of both types of government expenditures in Tables 9 and 10 (based on pooled OLS estimates of Tables 5 and 6), we observe that reducing non-development expenditure at a higher level of institutional quality enhances economic growth more when compared to the effect of reducing development expenditure. At a high institutional quality level of 4, if non-development government expenditure is reduced by 10% (Table 10), then growth increases by 2.5%; whereas at the same level of institutional quality, with similar fall in development government expenditure (Table 9), growth increases by 1.8%. It is also to be noted, that similar to the findings for marginal growth effect of aggregate government

Table 9. Marginal Effects of govt size on growth depending upon quality (Considering development government expenditure, Pooled OLS).

	1	2	3	4	5	6
Quality = 1	−0.068***	−0.093***	−0.085***	−0.073***	−0.070***	−0.096***
	(0.026)	(0.028)	(0.028)	(0.029)	(0.032)	(0.031)
Quality = 2	−0.107***	−0.126***	−0.088***	−0.081***	−0.069***	−0.115***
	(0.029)	(0.035)	(0.031)	(0.027)	(0.036)	(0.041)
Quality = 3	−0.145***	−0.159***	−0.0911***	−0.089***	−0.069***	−0.134***
	(0.039)	(0.044)	(0.023)	(0.030)	(0.042)	(0.052)
Quality = 4	−0.184***	−0.193***	−0.094***	−0.096**	−0.068***	−0.153***
	(0.052)	(0.054)	(0.042)	(0.038)	(0.048)	(0.065)

Note: Total development expenditure as a % of GDP (a proxy for government size). Robust homoscedastic standard errors are reported in parenthesis. *, **, *** denote significance at 10%, 5 %and 1 % levels respectively.

https://doi.org/10.1016/j.heliyon.2019.e01352

Table 10. Marginal Effects of govt size on growth depending upon quality (Considering non-development government expenditure, Pooled OLS).

	1	2	3	4	5	6
Quality = 1	−0.107***	−0.125***	−0.121***	−0.108***	−0.104***	−0.132***
	(0.035)	(0.038)	(0.037)	(0.038)	(0.041)	(0.041)
Quality = 2	−0.155***	−0.167***	−0.126***	−0.121***	−0.109***	−0.156***
	(0.040)	(0.045)	(0.041)	(0.037)	(0.045)	(0.052)
Quality = 3	−0.203***	−0.208***	−0.130***	−0.134***	−0.099*	−0.180***
	(0.053)	(0.056)	(0.046)	(0.043)	(0.053)	(0.065)
Quality = 4	−0.251***	−0.251***	−0.134***	−0.146**	−0.097	−0.205***
	(0.069)	(0.069)	(0.054)	(0.054)	(0.062)	(0.080)

Note: Total Non-Development expenditure as a % of GDP (a proxy for government size). Robust homoscedastic standard errors are reported in parenthesis. *, **, *** denote significance at 10%, 5% and 1 % levels respectively.

Table 11. Accounting for Endogeneity: System GMM estimation, full sample (Considering aggregate government expenditure).

Spec: Institutional proxy	Social Progress Index		Governance index		Personal safety		Inclusion	
	1	2	3	4	5	6	7	8
ln (Initial per capita GDP)	−0.0022	−0.0012	−0.0032	−0.0058	−0.0037	−0.0698	−0.0017	−0.0056
	(0.0132)	(0.0111)	(0.0114)	(0.0109)	(0.0107)	(0.0111)	(0.0108)	(0.0120)
Government size	−0.0455**	−0.0386*	−0.0446*	−0.0646**	−0.0384**	−0.0314*	−0.0450**	−0.0577*
	(0.0204)	(0.0201)	(0.0218)	(0.0289)	(0.0180)	(0.0182)	(0.0205)	(0.0246)
Physical capital	0.0664	0.131	0.0725	0.107	0.0456	0.0532	0.0588	0.0854
	(0.0983)	(0.106)	(0.0900)	(0.0935)	(0.107)	(0.104)	(0.107)	(0.117)
Human capital	-	-	-	-	0.0035	0.0117	0.00454	0.0077
					(0.0146)	(0.0148)	(0.0178)	(0.0175)
Quality index	0.00016	−0.0009	0.00028	0.00013	0.00164	0.0014	0.00020	0.0032
	(0.0016)	(0.0015)	(0.0016)	(0.0015)	(0.0012)	(0.0012)	(0.0012)	(0.0013)
Govt size * quality		−0.0300**		−0.0183**		0.00703		−0.0079
		(0.0130)		(0.0075)		(0.0043)		(0.0081)
Hansen p-value	1.00	1.00	0.853	0.714	0.937	0.884	0.952	1.000
AR (1) value	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
AR (2) value	0.475	0.558	0.485	0.494	0.501	0.484	0.494	0.523
Observations	184	184	184	184	184	184	184	184

Note: The models are estimated using system GMM(SYSTEM-GMM). The dependent variable is real GDP per capita growth rate. Total expenditure as a % of GDP has been taken as a proxy for government size. Robust standard errors are reported in parenthesis below each coefficient estimate. The Hansen test evaluates the validity of instrument set, i.e. tests for overidentifying restrictions.AR
(1) and AR
(2) are the Arellano- Bond autocorrelation tests of first and second order
(The null is no autocorrelation), respectively. Time effects have been included but are not reported for reasons of parsimony. *, **, *** denote significance at 10%, 5% and 1% levels respectively.

expenditure, irrespective of the composition of government expenditure considered, as the quality of the institution improves, the negative growth impact dampens.

Thus, the broad conclusions from this part of our analysis indicate that irrespective of the type of government expenditure considered, an increase in the same is

https://doi.org/10.1016/j.heliyon.2019.e01352

detrimental for economic growth. However, if the quality of institutions is better, then this detrimental impact is smaller compared to the cases where institutions are weaker. Also, the reduction in non-development government expenditure has a better growth impact compared to the reduction in development of government expenditure, especially for higher levels of institutional quality.

4.2. Robustness check: dynamic panel estimation

A natural concern about this interaction model is the possible endogeneity of government size and institutional quality. Keeping this in mind, we include lagged real GDP per capita in our regression equations. As in Afonso and Jalles (2016), we use the Arellano-Bover system-GMM (1995) estimation method with appropriate instruments and the results of the same in Tables 11, 12, and 13 support our previous findings.

Table 12. Accounting for Endogeneity: System GMM estimation, full sample (Considering development government expenditure).

Spec: Institutional proxy	Social Progress Index		Governance index		Personal safety		Inclusion	
	1	2	3	4	5	6	7	8
ln (Initial per capita GDP)	−0.003 (0.0136)	−0.002 (0.0124)	−0.004 (0.0116)	−0.006 (0.0121)	−0.00352 (0.0108)	−0.00478 (0.0112)	−0.00298 (0.0141)	−0.00369 (0.0139)
Government size	−0.0739** (0.0342)	−0.0636* (0.0324)	−0.0710* (0.0360)	−0.0908* (0.0463)	−0.0747* (0.0368)	−0.0757* (0.0386)	−0.0734** (0.0337)	−0.0776* (0.0377)
Physical capital	0.0735 (0.0947)	0.124 (0.102)	0.0827 (0.0845)	0.125 (0.0931)	0.0843 (0.0977)	0.0862 (0.0971)	0.0797 (0.112)	0.0780 (0.114)
Human capital	-	-	-	-	0.00787 (0.0174)	0.00967 (0.0181)	0.0165 (0.0172)	0.0160 (0.0189)
Quality index	6.49e-05 (0.00177)	−0.00071 (0.00170)	0.000350 (0.00164)	0.000128 (0.00156)	−0.000704 (0.000876)	−0.000714 (0.000868)	−0.00112 (0.00189)	−0.000976 (0.00189)
Govt size * quality		−0.0306* (0.0172)		−0.0222 (0.0131)		0.000862 (0.00502)		0.00273 (0.0133)
Hansen p-value	0.888	0.436	0.513	0.188	1.000	1.000	1.000	1.000
AR (1) value	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
AR (2) value	0.480	0.515	0.494	0.501	0.496	0.499	0.525	0.477
Observations	184	184	184	184	184	184	184	184

Note: The models are estimated using system GMM(SYSTEM-GMM). The dependent variable is real GDP per capita growth rate. Total development expenditure as a % of GDP has been taken as a proxy for government size Robust standard errors are reported in parenthesis below each coefficient estimate. The Hansen test evaluates the validity of instrument set, i.e. tests for overidentifying restrictions.AR
(1) and AR
(2) are the Arellano- Bond autocorrelation tests of first and second order
(The null is no autocorrelation), respectively. Time effects have been included but are not reported for reasons of parsimony. *, **, *** denote significance at 10%, 5% and 1% levels respectively.

https://doi.org/10.1016/j.heliyon.2019.e01352

Table 13. Accounting for Endogeneity: System GMM estimation, full sample (Considering non-development government expenditure).

Spec: Institutional proxy	Social Progress Index		Governance index		Personal safety		Inclusion	
	1	2	3	4	5	6	7	8
ln (Initial per capita GDP)	−0.00437 (0.0135)	−0.00163 (0.0125)	−0.00431 (0.0118)	−0.00606 (0.0123)	−0.00497 (0.0116)	−0.00468 (0.0116)	−0.00247 (0.0120)	−0.00218 (0.0124)
Government size	−0.105** (0.0489)	−0.0995** (0.0471)	−0.103* (0.0510)	−0.124* (0.0610)	−0.0812* (0.0426)	−0.0657 (0.0385)	−0.101* (0.0487)	−0.115** (0.0491)
Physical capital	0.0824 (0.0918)	0.119 (0.102)	0.0834 (0.0826)	0.121 (0.0933)	0.0607 (0.0976)	0.0629 (0.0968)	0.0695 (0.0985)	0.0895 (0.116)
Human capital	-	-	-	-	0.0127 (0.0201)	0.0100 (0.0170)	0.00464 (0.0221)	−0.00349 (0.0216)
Quality index	0.000267 (0.00173)	−0.000646 (0.00171)	0.000298 (0.00169)	0.000263 (0.00159)	0.00147 (0.00130)	0.00120 (0.00118)	0.000446 (0.00137)	0.000755 (0.00145)
Govt size * quality		−0.0386* (0.0212)		−0.0285* (0.0165)		0.0199 (0.0135)		−0.0108 (0.0164)
Hansen p-value	0.002	0.002	0.003	0.002	0.863	0.973	0.983	1.000
AR (1) value	0.461	0.522	0.470	0.460	0.002	0.002	0.002	0.002
AR (2) value	0.757	0.704	0.642	0.507	0.495	0.442	0.484	0.501
Observations	184	184	184	184	184	184	184	184

Note: The models are estimated using system GMM(SYSTEM-GMM). The dependent variable is real GDP per capita growth rate. Total non-development expenditure as a % of GDP has been taken as a proxy for government size. Robust standard errors are reported in parenthesis below each coefficient estimate. The Hansen test evaluates the validity of instrument set, i.e., tests for overidentifying restrictions.AR
(1) and AR
(2) are the Arellano- Bond autocorrelation tests of first and second order
(The null is no autocorrelation), respectively. Time effects have been included but are not reported for reasons of parsimony. *, **, *** denote significance at 10%,5% and 1% levels respectively.

5. Conclusion

We provide new evidence on whether too much government is good or bad for the Indian states when associated with different levels of institutional quality. For assessing the quality of institutions at the sub-national or the state-level, we have employed a new dataset, namely, the Social Progress Index. Based on pooled OLS estimation, panel random effects estimation, and system-GMM estimation of an augmented Solow growth model equation, and our study indicates that −(i) bigger governments tend to hamper the economic growth of states irrespective of different proxies for government size; (ii) institutional quality measured by the Social Progress Index has a positive impact on the per capita economic growth at the state-level; (iii) the detrimental growth impact of government size is more pronounced for those states that have lower quality of institutions, while this negative effect is less for states with better quality of institutions; (iv) non-development government expenditure

https://doi.org/10.1016/j.heliyon.2019.e01352

is more distortionary for economic growth in comparison to development government expenditure at higher levels of institutional quality irrespective of selected different proxies for the institutional quality. Our findings lead us to conclude that governments should maximize governance quality and minimize its size to enhance state-level economic growth.

Declarations

Author contribution statement

Nupur Nirola: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Sohini Sahu: Conceived and designed the experiments; Analyzed and interpreted the data; Wrote the paper.

Funding statement

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Competing interest statement

The authors declare no conflict of interest.

Additional information

No additional information is available for this paper.

Acknowledgements

The authors express their gratitude to two anonymous referees for their useful comments on an earlier draft of this paper.

References

Afonso, A., Furceri, D., 2010. Government size, composition, volatility, and economic growth. Eur. J. Political Econ. 26 (4), 517−532.

Afonso, A., Jalles, J., 2011. Economic Performance and Government Size. European Central Bank Working Paper Series, No. 1399.

Afonso, A., Jalles, J.T., 2014. Fiscal composition and long-term growth. Appl. Econ. 46 (3), 349−358.

https://doi.org/10.1016/j.heliyon.2019.e01352

Afonso, A., Jalles, J.T., 2016. Economic performance, government size, and institutional quality. Empirica 43 (1), 83–109.

Aiken, L.S., West, S.G., Reno, R.R., 1991. Multiple regression: Testing and interpreting interactions. Sage.

Angelopoulos, K., Philippopoulos, A., 2008. Does public sector efficiency matter? Revisiting the relation between fiscal size and economic growth in a World sample. Publ. Choice 137, 245–278.

Arellano, M., Bover, O., 1995. Another look at the instrumental variable estimation of error-components models. J. Econom. 68 (1), 29–51.

Barro, R.J., 1990. Government spending in a simple model of endogenous growth. J. Political Econ. 98 (5, Part 2), S103–S125.

Barro, R.J., 1991. Economic growth in a cross section of countries. Q. J. Econ. 106 (2), 407–443.

Bergh, A., Bjørnskov, C., 2011. Historical trust levels predict the current size of the welfare state. Kyklos 64 (1), 1–19.

Bergh, A., Henrekson, M., 2011. Government size and growth: a survey and interpretation of the evidence. J. Econ. Surv. 25 (5), 872–897.

Bergh, A., Karlsson, M., 2010. Government size and growth: accounting for economic freedom and globalization. Publ. Choice 142 (1-2), 195–213.

Bhattacharjee, J., 2016. Economic growth of states in India: does governance matter? J. Gov. Publ. Policy 6 (1), 24.

Brambor, T., Clark, W.R., Goldar, M., 2006. Understanding interaction models: improving empirical analyses. Polit. Anal. 13, 1–20.

Butkiewicz, J.L., Yanikkaya, H., Gebze, K., 2011. Institutions and the impact of government spending on growth. J. Appl. Econ. 14 (2), 319.

Chandra, R., 2004. Government Size and Economic Growth: an Investigation of Causality in India. Indian Economic Review, pp. 295–314. http://www.jstor.org/stable/29793817.

Devarajan, S., Swaroop, V., Zou, H.F., 1996. The composition of public expenditure and economic growth. J. Monet. Econ. 37 (2), 313–344.

Fölster, S., Henrekson, M., 2001. Growth effects of government expenditure and taxation in rich countries. Eur. Econ. Rev. 45 (8), 1501–1520.

https://doi.org/10.1016/j.heliyon.2019.e01352

Kaufmann, D., Kraay, A., Mastruzzi, M., 2010. The Worldwide Governance Indicators: Methodology and Analytical Issues. World Bank Policy Research Working Paper. No. 5430. World Bank, Washington, D.C.

Landau, D., 1986. Government and economic growth in the less developed countries: an empirical study for 1960–1980. Econ. Dev. Cult. Change 35 (1), 35–75.

Lucas Jr., R.E., 1988. On the mechanics of economic development. J. Monet. Econ. 22 (1), 3–42.

Mathew, C.K., Dutta, Udita, Narayanan, Architha, Jalodia, Shulka, 2017. Public Affairs Index (2017): Governance in the States of India. PAC, Bangalore.

Mathew, C.K., Pulavarti, Lalita, Dutta, Udita, Nikam, Manasi, Kannan, Devika, Bhardwaj, Sukriti, Goswami, Stuti, Vijay, Nikhila, Nambiar, Mahadevan, 2018. Public Affairs Index (2018): Governance in the States of India. PAC, Bangalore.

Matthew, K., Mukundan, Athreya, Divekar, Vivek, 2016. Public Affairs Index: Governance in the States of India. PAC, Bangalore.

Mundle, S., Chakraborty, P., Chowdhury, S., Sikdar, S., 2012. The quality of governance: how have Indian states performed? Econ. Pol. Wkly. 41–52.

Mundle, S., Chowdhury, S., Sikdar, S., 2016. Governance performance of Indian states. Econ. Pol. Wkly. 51 (36), 55–64.

North, D.C., 1989. Institutions and economic growth: an historical introduction. World Dev. 17 (9), 1319–1332.

North, D.C., 1991. Institutions. J. Econ. Perspect. 5 (1), 97–112.

Oto-Peralías, D., Romero-Ávila, D., 2013. Tracing the link between government size and growth: the role of public sector quality. Kyklos 66 (2), 229–255.

Rajkumar, A.S., Swaroop, V., 2008. Public spending and outcomes: does governance matter? J. Dev. Econ. 86 (1), 96–111.

Rodrik, D., 2008. One Economics, Many Recipes: Globalization, Institutions, and Economic Growth. Princeton University Press.

Rodrik, D., Subramanian, A., Trebbi, F., 2004. Institutions rule: the primacy of institutions over geography and integration in economic development. J. Econ. Growth 9 (2), 131–165.

Romer, P.M., 1986. Increasing returns and long-run growth. J. Political Econ. 94 (5), 1002–1037.

Seshaiah, S.V., Reddy, T.K., Sarma, I.R.S., 2018. General government expenditure and economic growth in India: 1980-81 to 2015-16. Theor. Econ. Lett. 8 (04), 728.

https://doi.org/10.1016/j.heliyon.2019.e01352

Shivaranjani, V., 2010. Size and Composition of Government Expenditure in India (Unpublished Master Dissertation). Anna University Chennai.

Social Progress Index, 2017. Social Progress Index: States of India 2017. Retrieved from. https://socialprogress.in/longitudinal-2005-2016-results-interactive-tool/.

Wu, S.Y., Tang, J.H., Lin, E.S., 2010. The impact of government expenditure on economic growth: how sensitive to the level of development? J. Policy Model. 32 (6), 804–817.

https://doi.org/10.1016/j.heliyon.2019.e01352