Viewing Development in India as the Outcome of Improved Governance and Infrastructure: An Empirical Exploration

Arnab Dutta Choudhury
Doctoral Research Scholar (full-time)
Department of Economics
Assam University, Silchar
Assam 788011, India

Ritwik Mazumder
Professor,
Department of Economics
Assam University, Silchar
Assam 788011, India

Abstract

Based on state-level panel data for India for the period 1990 to 2019 we empirically establish that the wide interstate inequalities in the basic indicators of development can be explained in terms of the disparities in physical infrastructure and the quality of governance after controlling for state-level structural economic factors. Our robust dynamic panel regression estimates validate this claim. Results clearly show that the level of urbanization coupled with infrastructure and governance lead to better development outcomes in terms of all three fundamental dimensions – per capita income, life expectancy and literacy rates. As levels of governance and infrastructure in India are very unequal across states and regions, we conclude that improved governance and effective spending on social overhead capital in poorer and largely underdeveloped regions are essential for improvements in the basic indicators of development across the country. Finally, the results of the stochastic frontier with inefficiency effects reveal that efficiency of public spending is higher for states with improved governance.

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JEL Classification: *H51, H52, H54, O15, O18 and C 23.*

1. Introduction

Governance plays a vital role in promoting and sustaining the levels of development attainments. Viewed as service delivery, good governance implies a way of efficient management and functioning of various institutions with transparency and accountability for effective delivery of basic public services like health, education, transport and communications, power and water supply, among numerous others. On the other hand, availability of adequate social and economic infrastructure facilities is also a prerequisite for the overall economic and social development. Especially in the Indian context, better access to educational and health facilities, safe drinking water and sanitation, roads, electricity and other forms of social overhead capital, is likely to yield better development outcomes. The fundamental question that we address in this paper is, "can the disparities in development attainments across Indian states and union territories be explained in terms of variations in governance quality and provisioning of basic infrastructure?" In other words, is development

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the outcome of good governance in conjunction with social overhead infrastructure? The fact that infrastructure is very unequally distributed across India is well reported in Majumder (2005). While physical infrastructure, such as roads, power supply, transport and telecommunications etc., are tangible and measurable, governance quality is largely perceptive in nature (Saxton, 2021). The World Bank (1992) defines governance as "the manner in which power is exercised in the management of a country's economic and social resources for development". However, a concept of governance that is suitable for assessing governance quality of Indian states should ideally be based on governance performance indicators in terms of efficient service delivery to citizens on the one hand, and indicators for corruption and functioning of the judiciary on the other. With few modifications we mostly follow Mundle *et al* (2012 and 2016), and use governance performance indicators in this paper to capture governance quality where the key objective of governance is to enhance overall well-being of citizens. Under a production function paradigm, we explain development outcomes employing governance and infrastructure as exogenous inputs under a state-level panel data set-up. We routinely control for state level structural economic factors like poverty, urbanization and extent of agriculture and allied activities. Our findings are supportive of the premise that better governance coupled with improved infrastructure has led to better economic development outcomes in India in recent years. The paper is written in the following sections. After a brief introduction and a basic outline of our work in section 1, we highlight some influential literature and research gap related issues in section 2followed by data and methodological issues in section 3. Empirical results are discussed in sections 4 and 5 while conclusions are drawn in section 6.

2. LiteratureReview

Literature on infrastructure, governance and economic development is quite vast as it is well studied area in empirical development economics throughout the globe.Consequently, a comprehensive review is beyond the scope of this paper. We only recapitulate studies on India's infrastructure, governance and development that influence our present work. More than three decades ago Ashauer (1989)wrote a seminal paper linking productivity growth to supply of basic infrastructure. The paper argued for a reconsideration of the role of government policy in promoting development. Moreover, the paper had a case for greater role of the public sector when mainstream economists were arguing in favour of downsizing the public sector and favouring the private sector (Munnell, 1990 and Button, 1998). In the Indian context, the contribution of infrastructure to economic growth is also well reported. Sahoo and Dash (2009) employed the growth-accounting technique to investigate the impact of infrastructure development on output. Their findings show that both private and public investments in infrastructure significantly promote economic growth. They also find a unidirectional causality from infrastructure to output growth. Using a VECM approach, Pradhan and Bagchi (2013) investigate the causality between transportation infrastructure and economic growth in India for the period 1970-2010 and find that both road and railway infrastructure causes economic growth. In some instances, they also find bi-directional causality between components of transport infrastructure and economic growth. Kumari and Sharma (2017) on the other hand distinguish between economic and social infrastructure. They useunrestricted VAR and Granger causality approaches to test for possible causal relationships among social, physical infrastructure and economic growth. Their findings support the hypothesis that economic and social infrastructure have positive influences oneconomic growth in India. However, their period of study is much shorter (1995-2013)than what we cover in this paper. Chakraborty and Guha (2009) examine whether village level infrastructure can generate economic growth in India by constructingcomposite infrastructureindex. The study acknowledges the role of both public and private sector in this regard. Majumder (2005) points out that inequalities in infrastructure provisioning across India is a key reason behind disparities in development attainments. On the basis of district level data, the study adopts a multidimensional approach with sub-sectoral, sectoral and composite indexes of infrastructural provisioning. The study finds considerable association between infrastructure and development levels across regions although the author points out the extent has dropped in recent years. The author is of the view that infrastructure development must be region specific and must be backed-up by cost-benefit analysis. Studies on the linkages between infrastructure and health outcomes in India are also reported in literature. For example, Gupta and Mitra (2004) explore the possible links between economic growth, poverty and health, on the basis of state level panel data for India. Findings indicate that, economic growth and health status are positively associatedandimproved health augments growth by improving productivity. Furthermore, expenditure on health is an important determinant of both higher growth and better health status, and is therefore a key tool for policy-makers. Also, literacy levels and industrialisation are found to have positive impacts on both health outcomes and growth, and to reduce poverty.In a remarkable study,Kathuria and Sankar (2005) examine the performance of the rural public health systems of 16 major Indian states using stochastic production frontier for the period 1986-97. The study reveals that states differ in terms of health infrastructure as well as efficiency of infrastructure usage. A handful of studies are also available that examine the impact of governance on development in case of India. Afridi (2017) is of the view that people in low-income countries like India are dependent on the state for provision of basic services. The study recognizes incentives, transparency and state capacity as important factors behind reducing the ineffectiveness of governance in India. The paper points out that in India efficient governance through public service provisioning can augment economic growth. Dash and Raja (2009) observe that the quality of governance has an impact on economic growth and development. They explain variations in the per capita GDP across Indian states and also the level of industrialization by means of governance indicators especially efficiency of the judiciary and legal institutions. Findings suggest that governance quality is significant in explaining the variations in state level per capita GDP. Institutional factors play a substantial role in explaining variations in the degree of industrial development as well across Indian states. In a pioneering effort Mundle*et. al.* (2012) systematically definewhat exactly is meant by good governance in the Indian context especially when it comes to the measurement and quantification of governance quality in terms of efficient delivery of basic public services towards citizens. The paper develops several indexes to capture the quality of governance and then ranks Indian states based on these indexes. Most importantly the paper shows that there is a significant and positive association between governance quality and development outcome at the state level. Based on a build -up over the 2012 study, Mundle*et. al.* (2016) rank Indian states between 2001 and 2011, on five sets of criteria – infrastructure, social services, fiscal performance, justice, law and order, and quality of legislature. The study finds little or no tendency of the lower ranked states to climb up to higher ranks in 2011 over the corresponding 2001 ranks. Thus, consistency between the ranks at the top and at the bottom across 2001 and 2011 is indicative of rising regional inequality across more developed and less developed states. On somewhat similar lines, Bhanumurthy*et. al.* (2018) study the impact of quality of governance and public expenditure on human development attainments for Madhya Pradesh. The study considers five dimensions of governance – political, legal, economic, administrative and social at the district level. The findings suggest that the efficacy of public expenditures including social sector spending improves with improved governance indicators. In other words, public spending on its own does not guarantee desired development outcomes. Moreover, the authors pinpoint the weaker governance dimensions that could lead to better development outcomes especially in the low human development districts of the state. In contrast with the influential literature thus surveyed, our present work is very different. First, we apply panel data regression models for Indian states over the period 1990-2019 on key variables of interest covering governance, infrastructure and development. Second, we explain how governance and infrastructure

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influences development in the presence of a host of structural factors like poverty, urbanisation, and agricultural contribution, etc. Our paper is unique in the sense that under a panel data set up assuming a production function paradigm, we explain each dimension of development – per capita real incomes, life expectancy and literacy separately on the basis of infrastructure and governance indicators controlling for other state level selected structural economic factors like urbanisation, poverty, etc.Here infrastructure and governance indicators are taken as key explanatory factors that explain development outcomes in the presence of several socio-economic control variables. We finally verify whether efficiency of public spending in infrastructure, health and education is higher for states with improved governance by employing the stochastic production frontier with inefficiency effects.

3. Methodology

3.1 The Panel Regression

Toassess the impact of governance and infrastructure on the basic dimensions of development namely income, education and health (covering five different indicators at the state level)we adopt a panel data regression strategy for 30 Indian states and union territories spanning a period of 30years (1990 – 2019).Except per capita state GDP and state level social sector expenditures, several governance and infrastructure variables of interest are unavailable at the state level (especially for North-Eastern states) for pre-1990 years. The variable list along with data sources are listed in appendix **(**A1**)**.The panel is unbalanced as several variables of interest are unavailable across states for certain years (see appendix A1 for details). All regression models are log-linear and as such regression coefficients are partial elasticities of the outcome variable with respect to regressors. Although development is taken as an outcome of governance and infrastructure throughout the paper, we do control for selected structural economic factors that also influence the development outcome of states. The three dimensions of overall development outcomes considered in this paper are economic attainment (or well-being), educational attainment and health attainment. For the state level panel regressions, we take realper capita net state domestic product (PCNSDP at 2011-12 prices) as the indicator of economic attainment. Total literacy rate (LIT) and female adult literacy rate (FAL)are taken under the dimensions of educational attainment and finally under the dimension of health attainment we take both infant mortality rate (IMR) and life expectancy at birth (LEB). Each of these components are dependent variables in this paper. The predictors or explanatory variables at the state level are ‘infrastructure’ and ‘governance’ along with chosen socio-economic factors. Infrastructure indicators include ROADS (road density per 1000 square kilometers), ELTRC (electricity consumption per capita), PSCL (government primary schools per lakh population), RNM (registered nurses and mid-wives per lakh), DOC (doctors per lakh population), rural health sub-centres (HSC)and HOSP (hospital beds per lakh population). Thus, we include social overhead (i.e., physical) infrastructure, health infrastructure and basic educational infrastructure. From literature we identify those indicators of governance and infrastructure which have high degree of significance for development attainments at the state level. Under governance, we take state level social infrastructure indicators such as SANIT (percentage of households under safe sanitation), SDW (percentage of households having access to safe drinking water), and AWC (Anganwadi centers per lakh population) to capture factors that yield health and nutritional outcomes. Following Baliyan (2017), three indicators of financial governance at the state level areCAPEX (state level per capita capital expenditure), PCEDU(per capita expenditure state level educational expenditure) and PCMED (per capita state level health expenditure) are chosen. Basically, these are the annual governmentspendings on infrastructure, health and education. Private investment in these areas is avoided and is outside the purview of this study. Following Dash and Raja (2009) a proxy indicator of corruption TDL (i.e., transmission and distribution loss in electricity per capita, which captures leakages from the system) and an indicator of legal inefficiency or inefficiency of the judiciary PCPJ (or pending cases per judge in respective state high courts) are taken to capture two different indicators of state level governance quality. However, we exercise due caution in interpretations as both are indicators of poor governance. Total police per lakh state population (POL) and the percentage of women police in state level total police (PWP) are taken as governance factors that capture crime reporting (or even control) instruments. Every variable is appropriately normalized. Broadly our panel data setup is,

$$Y_{it}^{k} = \alpha + \gamma' Y_{i\,t-1}^{k} + \acute{I}\beta_1 + \acute{G}\beta_2 + \acute{C}\beta_3 + u_{it} \qquad (1)$$

Since all indicators are unavailable for every year our panel is unbalanced (see variable list in Table 1). Here, *I* is a vector of current and lagged infrastructure variables, *G* is vector of current and lagged governance variables (lagged regressor only for financial variables), and *C* is vector of state level control factors. The vector '*C'* includes URBAN[28] (percentage of state level urban population), BPL (headcount count poverty ratio at the state level), AGRI (percentage of state GDP from agriculture and allied activities), LFPR (labour force participation rate)[29] and SEXR (state level sex-ratio). These control factors are also potential development influencing factors, the effects of which should be controlled if we are to examine the influence of governance and infrastructure on development outcomes. Poverty, as captured by BPL, is a development retarding factor and has potentially explanatory power in determining development attainments. SEXR is taken as a social factor proxying the extent of gender equality and AGRI as the share of agrarian sector activity, or a proxy for informal sector size.

Finally,Y_{it}^{k}isthe kth development dimension for the ith state at year *t*. Per-capita income (PCNSDP, as economic well-being), life expectancy at birth (LEB) andinfant mortality rate (IMR) for health and finally, total literacy rate (LIT) as well as female adult literacy (FAL) for education are taken as development indicators across dimensions.

Table 1. Dimension wise variables used for governance, infrastructure and development

Governance		Infrastructure		Development	
Dimensions	**Variables**	**Dimensions**	**Variables**	**Dimensions**	**Variables**
Judiciary and Crime Control	TDL (-), PCPJ(-),POL(+)	Physical	ROADS (+), ELTRC(+)	Income	PCNSDP
Health	CFI (+), RNM(+), SDW(+),PCMED(+), SANIT(+),DOC(+)	Health	HOSP(+), HSC (+), AWC(+)	Health	IMR and LEB
Education	PCEDU(+)	Educational	PSCL(+)	Education	LIT and FAL
Financial	CAPEX(+)				

Source: Variable selections are based on researchers' own methodology.
Notes: Development dimension variables are the dependent variables while others are independent variable. Expenditures per capita include government sources of spending only. Expected signs of regression coefficients are in parenthesis.

[28]It is more or less accepted that urbanization in less developed countries is associated with economic growth, economic development and industrialization which in turn strengthen each other (Clemente *et al,* 2021). From classical urban economic theories(see Jacobs, 1969) the pace of growth of urbanisation has popularly been used as a proxy for economic growth. Moreover, for our data-set the simple correlation coefficient between URBAN and CAPEX is 0.73 ($p<0.001$), between URBAN and ROADS is 0.74 ($p<0.001$), that between URBAN and industrial share in state GDP is 0.69 ($p<0.001$) and between URBAN and FDI is 0.59 ($p<0.001$). Also, urbanisation is a proxy for the extent of formalisation of the state economy. FDI is thus avoided as a control.

[29]The labour force participation rate is well recognized as a growth and development influencing factor (see, Denton and Spencer, 1997). Moreover, the production function paradigm requires that some measure of work force participation in combination with capital stock and other inputs be used to explain output.

Thedynamic panel regression includes a lagged dependent variable as a regressor to adjust for serial correlation in the residuals [this is basically an AR(1) term]. Lagged per capita social-sector expenditures are also taken as regressors as these are expected to influence development outcomes only after some lag. Under the circumstances, the Generalised Method of Moments (GMM) is used as it provides consistent estimators of parameters in a dynamic panel regression model. A family of log-linear panel regression models is used for each dependent variable in order to bring out as much information as possible from the set of explanatory variables (Basu and Mazumder 2021). Each model is vital for policy analysis. All models in this paper are log-linear or in log-log form. The log-linear model has several advantages like linearization of non-linear data, robustness against outlier observations and possible control of heteroscedasticity in errors (but does not guarantee elimination). Most importantly, the regression coefficients can be interpreted as elasticities under a log-linear framework. As an econometric safeguard, strongly correlated variables are avoided in each regression model in order to address collinearity related issues. As such a correlation analysis is presented first. All standard errors are adjusted for heteroscedasticity using White's cross-sectional (heteroscedasticity) adjusted standard errors.As a prelude to the correlation and panel regression analysis, we start with a graphical representation of the wide regional disparities in governance, infrastructure and development indicators across Indian states.

3.2 Measurement of State–level technical efficiency of public expenditure

To capture the impact of governance on efficiency of public spending we adopt the stochastic production frontier with inefficiency effects for panel data developed by Battese and Coelli (1995). Here,capital expenditure per capita (CAPEX), health expenditure per capita (PCMED) and educational expenditure per capita(PCEDU) are assumed to explain per capita net state domestic product (PCNSDP at 2011 prices) for India at the state level for the period 1990-2019. But additional factors (controls) like labour force participation rate (LFPR) and the degree of urbanisation (URBAN) are also included. Our PCNSDP frontier model in log-linear form may be written as,

$$LOG(PCNSDP_{it}) = \alpha + \beta_1 LOG(CAPEX_{it}) + \beta_2 LOG(PCMED_{it}) + \beta_3 LOG(PCEDU_{it}) + \beta_4 LOG(controls_{it}) + (v_{it} - u_{it}) \quad (2)$$

Here v_{it} is assumed to be independently and identically normally distributed with zero mean and constant variance σ_v^2. Also v_{it} is independent of u_{it} which is a non-negative random variable assumed to account for technical inefficiency in public expenditures. Moreover u_{it} is assumed to be independently normally distributed with truncations at zero of the normal distribution $N(m_{it}, \sigma_u^2)$. This variable mean m_{it}, is a linear function of a host of non-input factors that may affect the spending efficiency of a state. In particular,

$$m_{it} = Z'_{it}\delta \quad (3)$$

WhereZ_{it}'s are state level (also time varying) inefficiency effects variables that can influence state specific technical efficiency of public expenditure. These Z_{it}'s are, SANIT, SDW, TDL, PCPJ, CFI, DOC andPOL(variable definitions are in the appendix A1). Also, a linear time trend term 'TIME' is kept as an additional inefficiency effects variable to understand the trend if of technical efficiency if any. The Battese and Corra (1977) parameterisation uses $\sigma^2 = (\sigma_v^2 + \sigma_u^2)and\gamma = \sigma_u^2/(\sigma_v^2 + \sigma_u^2)$. Here if $\sigma_u^2 = 0$ then $\gamma = 0$ and the frontier model boils down to an ordinary least squares regression model. Maximisation of the log-likelihood function provides simultaneous estimates of the parameters of the production function, parameters of the stochastic frontier (i.e., $\sigma^2$and γ) and the coefficients of the inefficiency

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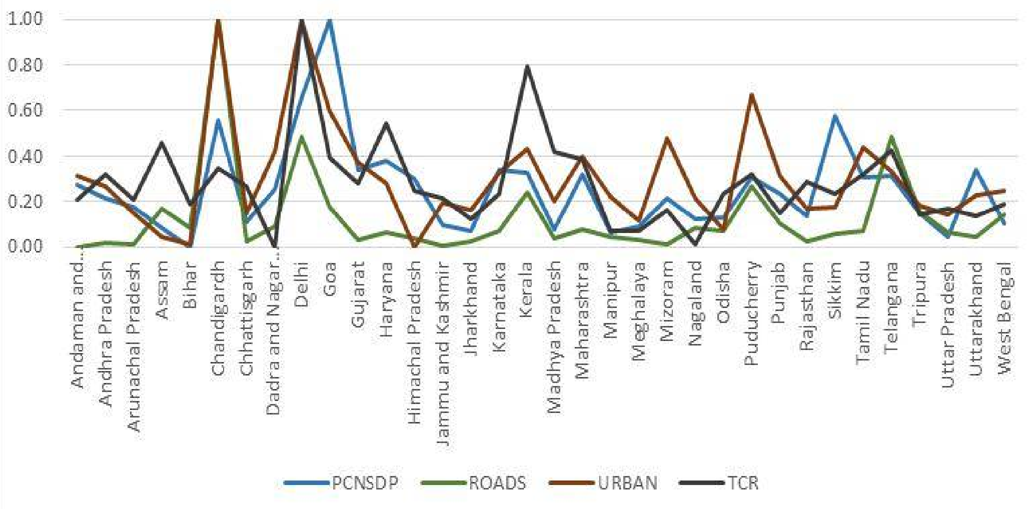
effects model (i.e., the δ's). The log-likelihood function is derived in terms of the variance parameters $\sigma^2$and γ. The technical efficiency of public expenditure for the i^{th} state and t^{th} period is given by $TE_{it} = Exp(-u_{it})$.

4. Disparity in per-capita incomes, infrastructure and Development Indicators

In Figure 1 we present a line plot based on the 2019-20 cross-section data on 33 states and union territories of India. Four crucial variables are chosen to bring out both the disparity across states and the association amongst these variables. These are PCNSDP, ROADS, URBAN, and TCR (total crimes reported per lakh population). These variables are transformed into a 0 to 1 scale for the sake of comparison using the well-known UNDP-HDI dimension index formula. Seemingly, there is some synchronization between the four chosen variables across Indian states and UT's. The figure reveals that richer Indian states are more urbanized and have better infrastructure. For instance, states and union territories like Delhi, Kerala, Tamil Nadu andPuducherry have upward spike in terms of all the four indicators but for the states like Bihar, Chhattisgarh, MP and UP there is a downward spike for the potted variables.

Fig. 1. Comparison between per capita NSDP, total road density, urbanisation and total crime reported among the Indian states and UT's



Source: Plotted by the authors on the basis of secondary data after transforming all variables to a 0 to 1 scale using HDI dimension index.

The line-plot also shows that TCR is higher in the richer and more urbanized regions with better physical infrastructure. Perhaps higher urbanisation, better infrastructure coupled with citizen friendly governance makes crime reporting much easier. From the line plot it is clear that there exists a wide disparity among the Indian states and union territories in terms of governance, infrastructure and economic well-being.

5. Empirical Results and Discussions

5.1 Bi-variate Correlations

In Table 2, we present simplebivariate correlations to examine the strength and direction of association among variables. The following observations can clearly be made based on the ordinary correlation coefficient values in the first column.

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Table 2. Bi-variate correlation coefficient between selecteddevelopment and socio-economic variables

Variables	PCNSDP	FAL	IMR	PCMED	PCEDU	URBAN	PCPJ	TDL	LEB	PSCL
PCNSDP	1									
FAL	0.38 (0.042)	1								
IMR	-0.60 (0.000)	-0.63 (0.000)	1							
PCMED	0.34 (0.047)	0.47 (0.005)	-0.38 (0.028)	1						
PCEDU	0.33 (0.056)	0.49 (0.003)	-0.39 (0.022)	0.94 (0.000)	1					
URBAN	0.58 (0.004)	0.43 (0.035)	-0.37 (0.048)	0.32 (0.051)	0.38 (0.049)	1				
PCPJ	-0.06 (0.720)	-0.54 (0.001)	0.24 (0.174)	-0.42 (0.015)	-0.45 (0.008)	-0.18 (0.300)	1			
TDL	-0.38 (0.042)	-0.11 (0.546)	0.40 (0.021)	0.19 (0.285)	0.07 (0.687)	-0.27 (0.072)	-0.06 (0.751)	1		
LEB	0.49 (0.003)	0.53 (0.001)	-0.76 (0.000)	0.32 (0.065)	0.32 (0.066)	0.45 (0.044)	-0.15 (0.384)	-0.30 (0.080)	1	
PSCL	0.39 (0.045)	0.12 (0.503)	-0.18 (0.315)	-0.24 (0.181)	-0.26 (0.138)	0.46 (0.031)	0.17 (0.334)	-0.20 (0.246)	0.12 (0.499)	1

Source: Calculated by the researcher on the basis of secondary data.
Notes: p-values are shown in parenthesis. The panel consists of 30 states and union territories for the period 1990-2019.Correlation coefficient between PCNSDP and CAPEX is 0.69 (p <0.001).

Richer Indian states and union territories have better levels of female adult literacy, lower infant mortality rates and higher life expectancy. Moreover per capita social sector expenditures are positively correlated with PCNSDP implying that richer states spend more per capita on health and education. Evidently, richer states are more urbanised and have better standards of governance (negative and significant correlation between PCNSDP and TDL). Even primary schools per lakh population are significantly higher are in the richer and relatively more urbanised states (positive and significant correlation between PCNSDP and PSCL). The other observation of interest is that, governance standards arebetter in the urbanised states and in states with better female adult literacy. The ordinary correlation coefficient between FAL and LIT turns out to be 0.83 which is statistically significant at 0.1% level (not reported in Table 2) meaning that states with higher FAL also tend to have higher LIT. We next turn to Table 3 for ordinary correlation coefficients, between health outcome variables, health infrastructure variables and a public spending variable.

Table 3. Bivariate ordinary correlations between governance, infrastructure and development indicators									
Variables	LEB	IMR	SDW	SANIT	CFI	DOC	RNM	HOSP	PCMED
LEB	1								
IMR	-0.76 (0.000)	1							
SDW	-0.03 (0.874)	0.04 (0.829)	1						
SANIT	0.67 (0.000)	-0.70 (0.000)	-0.21 0.244	1					
CFI	0.06 (0.737)	-0.10 (0.582)	0.17 (0.340)	-0.11 (0.563)	1				
DOC	0.32 (0.065)	-0.46 (0.006)	0.11 (0.534)	0.57 (0.001)	-0.04 (0.809)	1			
RNM	0.17 (0.350)	-0.203 (0.250)	0.11 (0.532)	0.29 (0.099)	0.21 (0.227)	0.75 (0.000)	1		
HOSP	0.48 (0.004)	-0.58 (0.000)	0.15 (0.405)	0.57 (0.001)	-0.22 (0.210)	0.79 (0.000)	0.50 (0.003)	1	
PCMED	0.34 (0.061)	-0.35 (0.052)	-0.03 (0.896)	0.41 (0.027)	-0.29 (0.108)	0.66 (0.000)	-0.06 (0.741)	0.61 (0.000)	1

Source: Calculated by the researcher on the basis of secondary data.
Notes: p-values are shown in parenthesis. The panel consists of 30 states and union territories for the period 1990-2019.

Our health outcome variable LEB is positively associated with health infrastructure as well as health expenditure per capita. Referring to the second column, IMR is seen to be significantly lower in states with better health infrastructure and higher spending. A noteworthy observation is that our two pivotal health governance indicators –the percentage of population having access to safe drinking water (SDW) and the child full immunisation percentage (CFI) is not significantly associated with any of the variables chosen. Moreover, the ordinary correlation between SDW and PCNSDP turns out to be just 0.006 (which is insignificant and not reported) and that between CFI and PCNSDP is 0.111 (p-value of 0.683, thus insignificant). Very similar is the correlation between SDW and URBAN (-0.017 with a p-value of 0.743) and CFI and URBAN (0.108, p-value 0.443). This indicates that SDW and CFI have in significant association with per capita incomes or the level of urbanisation in India. We turn to our panel regression estimates in the following subsection.

5.2 Results of panel regression

We finally turn to our unbalanced panel data regressions where we explain our development dimensions as outcome variables taking both governance and infrastructure as predictors in the presence of selected control variables. In table 4 we present five log-linear panel regression models for PCNSDP. We include a one period lagged dependent variable as a regressor in order to adjust for serial correlation in the errors. Throughout all models the one period lagged term is statistically significant. The Durbin-Watson statistic values for each of the models are

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reasonably close to 2.00 implying that the inclusion of the AR(1) term as regressor adjusts for serial correlation in the residuals.

The following observations based on the regression results in Table 4 are presented in order. All variables are not included in a model due to significant cross-correlations. Also, insignificant models are not reported. First, physical infrastructure is a significant factor that explains LOG(PCNSDP) positively and consistently across models. Both the coefficients of ROADS and ELTRC are statistically significant together in models 1, 3 and 5. Second, other things equal, physical infrastructure positively impacts economic well-being as captured by PCNSDP. Control factors like URBAN, AGRI and BPL are significant across models. Urbanisation positively influences development while poverty and the percentage of agriculture and allied activities have dampening effects on the same. The labour force participation rate (LFPR) also significantly influences PCNSDP in models 2 and 4. Third, both SANIT and SDW have positive and significant coefficients across models implying that governance quality, as proxied by percentage of population with access to safe sanitation and safe drinking water, is a positive factor behind economic well-being.

In fact, other governance variables like police per lakh population (POL) also has statistically significant and positive coefficients. Finally, indicators of poor governance as TDL and PCPJ have significantly negative influences on economic well-being, when other factors are suppressed. All three lagged public expenditure variables (CAPEX, PCMED, and PCEDU) positively influence PCNSDP implying that other things unchanged, infrastructure spending and social sector spending influence economic well-being in India. Only in case of CAPEX the second period lagged term is also significant (Models 1 and 5). Higher lags are statistically insignificant and are hence not reported. The big take-away from the results in Table 4 is that even after controlling for the influence of urbanisation, agricultural contribution and poverty, both infrastructure and governance have significantly positive influences on a very vital dimension of development – namely economic well-being.

Table 5 presents the regression results for two pivotal dimensions of educational outcomes – namely total literacy rate (LIT) and female adult literacy (FAL) rate. Lagged LIT and FAL regressors are insignificant and hence such models are avoided. Somewhat similar to the results in Table 4, at the state level physical infrastructure significantly explains both educational outcomes, LIT and FAL. Primary schools per lakh population (PSCL) explains LIT in the second model but explains FAL throughout the three models. That is, other things unchanged, provisioning of primary school infrastructure is a positive and significant factor behind educational outcomes – especially female adult literacy.

Our other findings are also fairly similar to the PCNSDP models.Even in case of education, poor and agrarian states have negative coefficients and have lower educational outcomes, while the level of urbanisation has an education augmenting effect. In table 5 we introduce a new control factor, sex-ratio (SEXR) that can potentially influence educational outcomes at the state level. SEXR has positive coefficient that is significant at 5% both in models 1 and 4 (i.e., for LIT as well as FAL). A favourable sex ratio (number of females per 1000 males) is also seen to enhance educational outcomes especially female adult literacy. Coming to governance variables, both access to safe sanitation (SANIT) and safe drinking water (SDW) have significant coefficients with consistent signs (i.e., positive) in models where these are used. Similarly, both TDL and PCPJ have negative and significant coefficients implying that poor governance can lead to poor educational outcomes (here lower levels of TDL and PCPJ coefficients signify better governance standards). Lagged educational expenditure per capita (PCEDU) and capital expenditure per capita (CAPEX) have positive and significant coefficients across models. However, PCMED turns out to be insignificant across models and is dropped. Importantly enough, both capital expenditure and educational expenditure have positive impacts on educational outcomes. The overall observation from Table 5 is that infrastructure and governance have positive impacts on educational outcomes at the state level for the study period in the presence of chosen control factors that also influence educational attainments. We next turn to our findings on the health outcome panel regressions.

In Table 6 we present the panel regression results for health attainments or health outcomes across India for the study period. The key dependent variables in this case are life expectancy at birth (LEB) and infant mortality rate (IMR). Since high IMR is detrimental to development outcomes, the signs of the estimated coefficients must be interpreted with caution. In line with the per capita income models and the educational outcome models, a similar set of explanatory variables is included with a few relevant changes. The observations based on results in Table 6 are as follows. First physical infrastructure as well as governance has positive and significant impacts on LEB. These factors have a negative influence on IMR which is desirable. Thus, better physical infrastructure across states in India has the potential of raising life expectancy at birth and lowering infant mortality. Moreover, health infrastructure variables like hospital beds per lakh population (HOSP) and health sub-centres per lakh population (HSC) have significant positive impacts on LEB, although the same are desirably IMR reducing factors. Second, indictors of good governance such as safe sanitation access (SANIT), safe drinking water access (SDW), doctors registered per lakh population (DOC) and children's full immunisation percentage (CFI) all have life expectancy raising effects and infant mortality reducing effects across models in Table 6. Registered nurses and mid-wives per lakh population (RNM) has a LEB raising effect but is significant only in Model 1.

Even AnganwadiCentres per lakh population (AWC) have life expectancy enhancing effects and muted effects on infant mortality. In sum health infrastructure and as well as health governance factors play significantly positive roles in health outcomes or health attainments at the state level in India for the study period. Our poor governance quality indicator (TDL) has a negative coefficient in case of the LEB model, but a positive coefficient in case of the IMR model implying that poor governance tends to lower LEB and raise IMR, other things remaining equal (PCPJ fails to explain the health outcomes and is hence dropped).

Third, the degree of urbanisation tends to raise life expectancy while poverty and the extent of agriculture and allied activities tend to lower it. Contrary results are seen in case of impact of urbanisation and the other control factors on infant mortality. Agricultural contribution at the state level suppresses health attainments, which is very similar to the influence of poverty. Finally, both health expenditure per capita and capital expenditure per capita explain LEB in a desirable way, that is, higher state expenditures per capita on this sector leads to better health outcomes (muting IMR and boosting LEB).

Throughout all estimated models in tables 4, 5 and 6 we routinely do two tests in the context of panel data. In the basic step we test for the state specific fixed effects as opposed to pooled estimator. Throughout all models the null hypothesis of absence of fixed effects is rejected implying that statistically our state level panel data is more suited for state specific fixed effects. In the second step we test for the presence of random state effects (which actually is a test for correlated random effects) by employing the Hausman test. In each case the null hypothesis of correlated state specific random effects is rejected leading to acceptance of fixed state effects hypothesis. Since GMM provides consistent estimates of parameters, throughout the regression tables we only present GMM estimates. The Sargan J-statistic is insignificant in each case which implies acceptance of the null hypothesis of zero covariance of the instruments with the error (instruments are exogenous). This is also an adequate test for over-identifying restrictions in a regression model. As a passing note it is worth mentioning that each model is vital from the policy perspective as explanatory variables are strategically picked from variable groups in table 1.

We present our findings on the technical efficiency of government spending with inefficiency effects in Table 7. Lagged expenditures per capita in all three dimensions are taken as because current expenditure is not expected to impact current PCNSDP. Models with 2 period lags are insignificant and are not reported. All lagged expenditures per capita have positive and significant coefficients in Model 1 (where URBAN is dropped) implying that per capita capital expenditure, health expenditure and educational expenditure explain PCNSDP. In Model 2 when CAPEX is dropped URBAN turns out to be significant. Turning to the inefficiency effects parameters, coefficients of poor governance (TDL and PCPJ) are positive across models meaning that states with poor governance have lower technical efficiency of public spending. The good governance indicators like SDW, SANIT, CFI, DOC and POL, all have negative and statistically significant coefficients across models. The implication is that states with better standards of governance have higher technical efficiency of public spending on infrastructure, health and education.

The Gamma parameter is statistically significant at 5 per cent and has a value of around 0.70, implying that around 70 per cent of the total variation in the composed random disturbance can be accounted for by the inefficiency random variable. Moreover, the likelihood ratio test of the absence of inefficiency along with absence of inefficiency effects (H_0: $\gamma = \delta_0 = \delta_1 = \ldots = \delta_5 = 0$) is significant at 5 per cent. In other words, the stochastic frontier is statistically superior compared to the ordinary least squares in explaining LOG(PCNSDP). The remarkable finding from this exercise is that government spending is more efficient in states and union territories with better standards of governance. We now summarise our study in the concluding section.

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Table4. DynamicPanel Regression of PCNSDP on governance, infrastructure and control variables

Explanatory Variables	Model 1	Model 2	Model 3	Model 4	Model 5
Constant	1.087**(5.395)	1.615**(7.714)	1.133**(5.889)	-0.098(-0.267)	1.631**(9.255)
LOG(PCNSDP(-1))	0.860**(69.171)	0.814**(32.818)	0.819**(36.262)	0.796**(33.231)	0.813**(29.858)
LOG(ROADS)	0.024**(4.257)	0.011*(1.950)	0.021**(3.676)		0.015*(1.932)
LOG(ELTRC)	0.062**(3.758)		0.090**(4.429)	0.127**(6.192)	0.170**(6.921)
LOG(URBAN)		0.114**(5.751)			0.054**(2.740)
LOG(AGRI)		-0.059**(-5.065)		-0.057**(-2.001)	
LOG(BPL)	-0.033**(-3.073)		-0.025*(-2.245)		
LOG(SANIT)		0.055*(1.888)			0.064**(3.124)
LOG(SDW)		0.063**(2.398)	0.034*(1.747)	0.033*(1.668)	
LOG(POL)	0.025*(1.878)				
LOG(TDL)	-0.047**(-2.903)	-0.018(-1.092)	-0.048**(-2.878)		-0.058**(-2.831)
LOG(PCPJ)	-0.038**(-6.495)	-0.043**(-7.496)	-0.035**(-5.513)	-0.031**(-5.064)	
LOG(LFPR)		0.056**(6.680)		0.009*(1.888)	
LOG(CAPEX(-1)	0.174**(4.652)				0.183**(2.552)
LOG(CAPEX(-2))	0.033*(2.261)				0.029*(1.970)
LOG(PCEDU(-1))			0.028*(1.891)	0.040**(2.499)	
LOG(PCMED(-1))		0.048**(4.861)			0.054*(1.795)
Time	0.036**(4.009)	0.052**(7.418)	0.034**(5.113)	0.028**(4.401)	0.025**(9.508)
Adjusted R square	0.97	0.97	0.97	0.97	0.96
F statistics	2487.37**	2524.71**	1967.06**	2416.93**	2258.38**
Durbin-Watson	1.80	2.06	2.15	2.12	2.23
Redundant fixed effects F-test	134.08**	116.06**	128.29**	126.81**	138.47**
Hausman Test (χ^2)	137.290**	116.28**	129.83**	128.46**	143.08**
J-statistic (instrument rank) (p-value)	2.476 (9) (0.434)	3.322(9) (0.229)	2.729(9) (0.334)	7.768 (9) (0.299)	5.001 (9) (0.275)

Source: Estimated by the authors on the basis of secondary data.
Note: Numbers in the parentheses are t ratios where White's heteroscedasticity adjusted standard errors are used. Here ** and * means significant at 1% and 5% levels respectively. Dependent Variable: LOG(PCNSDP); Panel consists of 30 states for 1990-2019.Included observations 478.

Table 5. Panel Regression of infrastructure and governance on educational attainment for States and Union territories of India

Explanatory Variables	Dependent Variable: Log (LIT)		Dependent Variable: Log (FAL)		
	Model 1	Model 2	Model 3	Model 4	Model 5
Constant	0.278**(5.655)	0.371**(7.845)	0.585**(9.781)	0.187**(4.147)	0.225**(5.441)
LOG(ROADS)	0.006**(4.943)	0.004**2.276)		0.005(1.679)	
LOG(ELTRC)	0.011**(3.297)				
LOG(PSCL)		0.017*(1.786)	0.012*(2.389)	0.013**(2.652)	0.013**(2.829)
LOG(BPL)				-0.007(-1.470)	
LOG(AGRI)					-0.007(-1.554)
LOG(URBAN)		0.008*(1.988)	0.014*(1.987)		
LOG(SANIT)				0.023**(3.309)	0.025**(3.573)
LOG(SEXR)	0.030*(1.777)		0.365*(2.121)		
LOG(TDL)		-0.016(-1.311)	-0.015*(-2.077)		-0.012*(-1.701)
LOG(PCPJ)	-0.005**(-3.808)		-0.012**(-4.551)		
LOG(PCEDU(-1))		0.015**(4.138)			0.006*(1.776)
LOG(CAPEX(-1))	0.093* (2.001)			0.117*(1.966)	
Time	0.001*(2.032)	0.001**(2.671)	0.014**(5.165)	0.004**(2.304)	0.006**(3.664)
Adjusted R square	0.95	0.93	0.95	0.96	0.96
F statistics	1801.77**	1803.69**	1709.82**	2689.38**	3003.80**
Durbin-Watson	1.94	2.10	1.70	2.26	2.26
Redundant fixed effects F – Test	220.40**	52.16**	149.61**	60.60**	51.06**
Hausman Test	237.68**	50.33**	155.98**	58.18**	48.53**
J-statistic (instrument rank) (p-value)	3.331 (5) (0.249)	3.009(5) (0.317)	4.030 (5) (0.454)	3.997 (5) (0.332)	4.999 (5) (0.229)

Source: Estimated by the authors on the basis of secondary data.
Note: Numbers in the parentheses are t ratios where diagonally adjusted standard errors are used in all cases. Here ** and * means significant at 1%, and 5% level respectively. FE and RE represents fixed effects and random effects model respectively.Panel consists of 30 states for 1990-2019.

Table 6. Panel Regression of Health Attainment for the States and Union Territories in India

Explanatory Variables	Dependent Variable: Log(LEB)			Dependent Variable: Log(IMR)		
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Constant	0.824**(8.267)	0.780**(8.355)	0.587**(7.812)	0.107**(2.442)	0.241**(3.656)	-0.173**(-2.826)
LOG(ROADS)	0.020**(1.878)					-0.010*(1.699)
LOG(ELTRC)		0.004**(1.979)		-0.009*(-1.778)	-0.014*(-1.760)	
LOG(HOSP)			0.002*(1.701)			
LOG(AWC)	0.003*(1.949)					-0.013*(-1.710)
LOG(SANIT)			0.007**(3.480)		-0.060 (-1.656)	
LOG(SDW)			0.023*(1.802)			
LOG(HSC)		0.001*(1.699)			-0.014*(-2.142)	
LOG(AGRI)	-0.003**(-2.351)	-0.003*(-2.027)				0.004(1.765)
LOG(BPL)			-0.007*(2.132)	-0.061*(-1.803)		
LOG(URBAN)			0.003*(1.760)		-0.004(1.587)	
LOG(CFI)	0.006**(2.922)	0.006**(2.899)		-0.012*(-2.089)		
LOG(DOC)		0.002*(2.049)				-0.101*(2.223)
LOG(RNM)	0.001*(1.987)					
LOG(TDL)			-0.222 (1.683)			0.030**(3.086)
LOG(PCMED(-1))					-0.007**(-2.536)	
LOG(CAPEX(-1))		0.877*(2.119)				-1.122*(1.892)
Adjusted R square	0.85	0.86	0.86	0.98	0.98	0.98
F statistics	662.10**	760.94**	947.51**	12911.05**	7809.82**	6141.67**
Durbin-Watson	2.79	2.77	2.81	2.08	2.08	2.06
Redundant fixed effects F – Test	75.75**	64.73**	53.38**	71.32**	79.39**	60.39**
Hausman Test	69.95**	58.86**	47.15**	18.27**	23.89*	18.54**
J-statistic (instrument rank) (p-value)	1.486 (6) (0.333)	1.039(7) (0.439)	1.030 (7) (0.192)	1.991 (4) (0.243)	1.999 (6) (0.441)	1.776 (7) (0.202)

Source: Estimated by the authors on the basis of secondary data.
Note: Numbers in the parentheses are t ratios where diagonally adjusted standard errors are used in all cases. Here ** and * means significant at 1%and 5% levels respectively.

Table 7. Estimates of the Stochastic Frontier for Efficiency of Public Expenditure [Dependent variable: LOG(PCNSDP)]

Explanatory variables	Model 1	Model 2
Constant	2.199* (2.008)	2.093* (2.031)
LOG(PCNSDP(-1))	0.887** (2.656)	0.863** (2.779)
LOG(CAPEX(-1))	0.832** (3.033)	
LOG(PCEDU(-1))	1.001* (2.154)	1.407* (2.990)
LOG(PCMED(-1))	0.521 (1.546)	0.019* (1.989)
LOG(URBAN)	0.435 (1.133)	0.679** (2.932)
LOG(LFPR)	0.021 (1.554)	0.019 (1.409)
Inefficiency effects model estimates		
δ_0 (constant)	3.028 (1.065)	3.023 (1.079)
LOG(SANIT)	-0.067* (-1.991)	
LOG(SDW)		-0.011* (-2.011)
LOG(TDL)	0.003* (2.110)	
LOG(PCPJ)		0.027* (1.886)
LOG(CFI)	-0.264* (-2.006)	
LOG(DOC)		-0.890* (-1.883)
LOG(POL)	-0.011* (-2.212)	-0.019* (-2.330)
$\sigma^2 = \sigma_v^2 + \sigma_u^2$	0.031* (0.042)	0.030* (0.021)
$\gamma = \sigma_u^2 / (\sigma_u^2 + \sigma_v^2)$	0.713** (0.004)	0.699** (0.001)
Log Likelihood Value	-58.846	-59.233
LR Statistic for H_0: $\gamma = \delta_0 = \delta_1 = ... = \delta_k = 0$ (d.f. = 6)	19.325*	19.899*

Source: Estimated by the authors based on secondary data using FRONTIER 4.1 for Windows.
Notes: p-values are in parenthesis. For the test of $\gamma = 0$, the mixed Chi-square distribution critical values are obtained from Kodde and Palm (1986) Table 1, page 1246. The unbalanced panel contains 466 pooled observations covering 30 Indian states and UTs for the period 1990-2019.

6. Summary and Conclusions

Based on state level panel data for India for the period 1990-2019, we demonstrate that wide interstate variations in development attainments can be attributed to the disparities in infrastructure and governance when other development influencing factors are controlled for. We view economic development as the outcome of improved infrastructure coupled with good governance under a production function paradigm where state level structural variables like urbanisation and poverty are taken as control factors. Good governance here is viewed as effective deliveries of most basic services to citizens. We take all three fundamental dimensions of development – income, health and education, as outcomes. We finally examine whether efficiency of per capita social-sector spending in promoting economic well-being is higher for states with better standards of governance. The panel regression results reveal that governance quality coupled with infrastructure provisioning across sates and union territories of India lead to enhanced levels of per capita net state domestic product, better educational and health attainments. Among structural variables, the degree of urbanisation positively influences development while poverty and agricultural share have dampening effects. Finally, government spending is more efficient in raising real per capita incomes in states and union territories with improved levels of governance. In conclusion, infrastructure growth, pace of urbanisation and socio-economic development go hand in hand. Infrastructure development acts as a catalyst for rapid urbanisation which leads to formalisation of the economy. This structural transformation in conjunction with good governance plays a pivotal role in development outcomes. In particular, health and educational infrastructures lead to positive development outcomes only in the presence of efficient governance. The overall policy lesson of this paper is that, we need to frame policies that are designed to enhance the levels of infrastructure and revamp the structure of governance particularly in the backward states such that interstate disparities development can be bridged.

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Appendix

A1: Variable definitions and data sources

AGRI – Share of Agriculture and Allied Activities in GSDP (**Source:** RBI Hand Book of Statistics on Indian States. Data available for 1991-2019)

AWC – Anganwadi Centre per lakh population (**Source:** Researcher's Own Calculation Based on Lok-Sabha database. Data available for 1990 – 2000)

BPL – Percentage of Population Below Poverty Line (**Source:** NITI AYOG, GOI. Data available for Tendulkar Rounds only i.e., 1993, 2004, 2009, and 2011)

CAPEX – Per capita capital expenditure (**Source:** Authors' own calculations based on data drawn from RBI Hand Book of Statistics on Indian States. Data available for 1991-2019).

CFI – Children full immunization percentage of 12 – 23 months aged children (**Source:** NFHS survey rounds, 1992, 1998, 2005 and 2015. Data for 2016 – 2019 are collected from Press Information Bureau, GOI)

DOC – Doctor Per Lakh Population (**Source:** Researcher's own calculation based on data from Ministry of Health & Family Welfare, GOI. Data available for 1999, 2005, 2007, 2011, 2012, 2013, and 2017)

ELTRC – Percentage of Household Access to Electricity (**Source:** Ministry of Statistics and Programme Implementation, GOI. Data available for census years 1991, 2001 and 2011)

FAL – Female Adult Literacy Rate (**Source:** National Commission for Women and NSS Survey Rounds. Data for 1991 is taken from the former source while data for 1994, 2004, 2007, 2011, 2014 and 2017 are taken from the later)

HOSB - Hospital bed per lakh population (**Source:** Researcher's Own Calculation based on data from Ministry of Health & Family Welfare, GOI. Data available for 1993, 1998, 1999, 2000, 2001, 2002, 2006, 2011, 2016, 2017 and 2018)

IMR – Infant Mortality Rate (**Source:** RBI Hand Book of Statistics On Indian States. Data available for 1992 – 2019)

LEB – Life Expectancy at Birth (**Source:** globaldatalab.org. Data available for 1990 – 2019)

LIT – Total Literacy Rate (**Source:** RBI Hand Book of Statistics on Indian States. Data available for census years only i.e., 1991, 2001 and 2011)

LFPR – Labour Force Participation Rate for Persons of Aged 15 Years and Above (**Source:** Ministry of Statistics and Programme Implementation, GOI. Data available for 1999, 2011 and 2019)

PCEDU -Per Capita Expenditure on Education (**Source:** Researcher's own calculation based on data from Ministry of Human Resource Department and RBI State Finance. Data available for 1991 – 2019)

PCMED - Per Capita Expenditure on Medical and Public (**Source:** Researcher's own calculation based on data from National Institute of Public Finance & Policy for 1991, Lok-Sabha Database for 1999 and RBI State Finance for 2000 – 2019)

PCNSDP - Per Capita Net State Domestic Product at Constant Price (**Source:** Ministry of Statistics and Programme Implementation, GOI. Data available for 1990 – 2019)

PCPJ - Pending Cases Per Judge in The High Court (**Source:** Researcher's Own Calculation based on data from Supreme Court of India. Data available for 1997 – 2019)

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POL – Police per lakh state population (**Source:** Bureau of Police Research and Development, GOI. Data available for 1992 – 2019)

PSCL – Primacy School per lakh of the population (**Source:** Researcher's Own Calculation Based on MHRD data. Data available for 1991 – 2019)

HSC – Rural health sub centre per lakh population (**Source:** Researcher's own calculation based on data from Ministry of Health & Family Welfare, GOI. Data available for 1990 – 2019. Data points are given for each planning period)

RNM – Registered Nurses and Mid-wives Per Lakh Population (**Source:** Researcher's Own Calculation Based on data from Ministry of Health and Family Welfare, Lok-Sabha database and Press Information Bureau, GOI. Data available for 1991, 1994, 1995, 1999, 2001, 2003, 2007, 2008, 2010, 2011, 2013, 2014, 2017)

ROADS – Total Road Density Per 1000 Square Kilometre (**Source:** Researcher's Own Calculation based on Basic Roads Statistics, Ministry of Statistics and Programme Implementation, GOI. Data available for 1991 and 1995 – 2017)

SANIT – Percentage of Household Access to Toilet/Sanitation Facility (**Source:** Ministry of Statistics and Programme Implementation, GOI. Data available for census years 1991, 2001 and 2011)

SDW – Percentage of Household Access to Safe Drinking Water (**Source:** Ministry of Statistics and Programme Implementation, GOI. Data available for census years 1991, 2001 and 2011.)

TCR – Total Crime Reported Per Lakh Population (**Source:** Crime in India, National Crime Record Bureau, GOI. Data available for 1992 – 2019)

TDL – Transmission and Distribution Loss in electricity distribution (**Source:** RBI Hand Book of Statistics on Indian States. Data available for 1992 – 2016)

URBAN – Degree of urbanization expressed as percentage of Urban Population (**Source:** Ministry of Statistics and Programme Implementation, GOI. Data available for census years 1991, 2001 and 2011)

A2: List of Indian States and Union Territories for the study

Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Chhattisgarh, Delhi (UT), Goa, Gujarat, Haryana, Himachal Pradesh, Jammu and Kashmir, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Mizoram, Nagaland, Odisha, Puducherry (UT), Punjab, Rajasthan, Sikkim, Tamil Nadu, Tripura, Uttar Pradesh, Uttarakhand and West Bengal.

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