Institutions and Economic Development

Understanding the Evidence from Indian States

Submitted by:
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Abstract

Institutions have been called a 'deep determinant' of growth in countries. The empirical evidence is however limited at a sub-national level. This study examines how indicators of institutional quality influence economic growth. Fifteen indicators, each covering 21 Indian states over a period of 7 years, have been used to extract factors based on factor analysis using principal component factoring. First, three sub-indices spanning economic efficiency, governance capacity and law and order are constructed. Later, their average score is taken to finally arrive at the index of institutional quality. This index is then used in a formal growth regression framework developed by North (1981), employing pooled OLS and fixed effects based estimation methodologies. The findings suggest that favorable institutions have a positive and significant level as well as growth effect, i.e., they positively impact per capita income as well as its growth but with a lag. Finally, it is the indicators of governance capacity and economic efficiency that positively affect per capita income growth in a statistically significant manner- leaving us with a thought as to where developing country such as India should deploy more of its limited resources, at least in the short run.

Institutions and Economic Development

Introduction

"It is possible for a nation to stifle its economic growth by adopting passionately and intolerantly religious doctrines of a kind which are incompatible with growth"

Lewis 1955: 107

One of the great economists, Arthur Lewis responded with this statement when asked to comment on the failure of Spain in capitalizing the economic opportunities presented by discovery of the New World. Here, religious doctrines were just one form of institutions. This statement, however, laid the foundation for New Institutional Economics (NIE hereafter), which tried to understand what institutions are and how they played a role in explaining the differences in income across countries. Earlier, this was done under different frameworks prescribed by neo-classical growth models.

NIE has also dealt with the challenge of defining institutions. One of such pathbreaking attempts was by Douglas North (1990). He defined institutions as the formal and informal constraints on political, economic and social interactions. According to his definition, good institutions would mean those structures that put in place an "incentive structure" that reduces uncertainty and promotes efficiency. Since early 20th century, several attempts have been made by economists to pin down on the indicators that are illustrative of "good" institutions within the aforementioned framework. While there may be no consensus on their definition, there is acceptance of the fact that there is indeed no one particular characterization of it. Institutions can differ from country to country. Rodrik and Subramanian (2003) take the example of economic institutions to explain the cross-country heterogeneity in the same. For instance, China adopted a market system on a planned economy. East Asia combined outward orientation with industrial intervention while Chile mixed capital controls with orthodox economic arrangements. In light of these examples, it becomes difficult to decide which institutional arrangement is good and which is not.

Further, the theoretical and applied issues of the relationship between institutions and economic growth have been examined in both developed as well as developing countries. This has been an important domain of study because developing countries differ significantly from the developed countries in terms of their per capita incomes, resource endowments and geography where the former is clearly at a disadvantage from the latter. This has a bearing on "convergence" among countries, which in turn has worldwide welfare implications. Institutions are found to have a statistically significant impact on per capita income (Ganau (2017), Henisz (2000), Khalil et al (2007), Rodrik (2004), Hall and Jones (1999), Acemoglu, Johnson and Robinson (2001a), Easterly and Levine (2003), and Rodrik, Subramanian, and Trebbi (2002)). Rodrik, Subramanian and Trebbi (2002) call institutions a "deep determinant" of growth.

Rodrik (2008) prescribes developing countries to have a second-best mindset for institutional reforms as the institutions are very weak. However, India is an outlier. Subramanian (2007) argues that India has pro-active institutions such as the Supreme Court and many new empowered regulatory institutions like SEBI, IRDA have also come up.

Further, improving institutional quality in a developing country such as India can also help her to move towards her production frontier (Rodrik and Subramanian (2004) and Acemoglu, Aghion and Zilibotti (2006)). In fact, India's Asian rival China is also believed to have nurtured 'transitional' and 'heterodox' institutions to register exponential growth rates (Yingyi Qian, 2003)

While the empirical evidence positively linking institutions with economic growth as grown exponentially, the literature is rather limited at within countries, i.e, sub-national level. This despite

the empirically proven important role of institutions becomes the motivation for this study, which takes the specific case of India.

It is important to understand the role that institutions play at sub-national level for various reasons. First, different states have showed different economic performance. States such as Jharkhand, despite being natural resource rich has been a laggard in growth while natural resource deficient states such as Gujarat have registered high income growth (Economic Survey 2016-2017). This brings the "convergence" problem to sub-national level. Second, to the best of author's knowledge, there is no study that studies the impact of institutions on the economic trajectory in Indian setting. Liu, Tang, Zhou and Liang (2018) have investigated the impact of governance quality on economic growth in China at provincial level. Mundle et al (2012) create an index of governance and estimate its impact on economic growth in Indian states. but their study views institutions through the governance channel only. Nirola and Sahoo (2019) estimate the impact of government size on economic growth after interacting the government size with institutional quality. However, the index used is social progress index which misses out on other dimensions. Debroy and Bhandari (2013) have constructed an Index of Economic Freedom for Indian states but they do not analyze the impact of that index on economic growth across states. Subramanian (2007) delves upon the impact of institutional differences on states but there is no rigorous econometric analysis pertaining to the same. Finally, increasing thrust on decentralisation with state level governments increasingly becoming more prominent makes it important to understand the impact of quality of state level institutions.

In light of the above discussion, this study aims to study the impact of institutional quality on the economic performance of Indian states during the years 2011-2017. It seeks to make two novel contributions to the existing yet limited literature. One, index of institutional quality has been constructed using factor analysis with principal component factoring method. Within the index, three sub-indices are constructed that shed light on the market creation, governance capacity for public service delivery and law and order respectively. Second, the impact of institutions on per capita income and its growth, is analyzed using pooled OLS and fixed- effects based panel data estimation methodology. Another key empirical question explored is which of the three institutional quality indices has the most significant on income.

The paper is organized as follows. Section 1 introduced the paper alongwith relevant literature. Section 2 provides data description and analyses of indices. Section 3 discusses the research methodology and rationale for index formation. Section 4 discusses the empirical findings. Finally, the paper concludes while shedding light on policy recommendations and way forward.

Data Description

The author has assembled a panel dataset of twenty variables for twenty-one states of India from multiple sources for the years 2011-2017. Some states have been excluded from the analysis due to lack of complete and reliable data[1]. Another set of States/ UTs has been excluded owing to little to no variation in their performance as gauged by various socio-economic indicators. Also, UTs are administered by the Centre and thus, the impact of state level institutions cannot be gauged there. Only Delhi has been retained as it is jointly administered by an elected political party as well as the Centre[2].

The institutional economics literature has been rather divided on the choice of indicators that can be used as proxy for institutions because they operate through different channels. Several studies have tried to identify these channels. North and Thomas (1973) argued that good institutions strengthen property rights and incentive structures while minimizing transaction costs.

[1] These states include Telangana and North-Eastern states of Arunachal Pradesh, Manipur, Meghalaya, Sikkim, Mizoram, Tripura and Nagaland.
[2] These States/ UTs include Andaman and Nicobar Islands, Daman and Diu, Dadra and Nagar Haveli, Lakshadweep, Chandigarh, and Puducherry.

Similarly, Rodrik and Subramanian (2004) have identified four primary roles of institutions: market creating (property rights, contract enforcement), market regulating (presence of regulatory agencies in say telecom sector, transport and financial services), market stabilizing (low inflation, lower macroeconomic volatility) and market legitimizing (democracy, social protection and social insurance). World Governance Indicators by the World Bank make use of over 300 indicators covering objective as well as perception based data, to construct institutional quality indices. However, Olken and Pande (2011) have highlighted the issues associated with perception-based survey, heterogeneity among respondents being one.

For choosing the variables, this study has employed a three-check process borrowed from Debroy and Bhandari. First, only objective data points and not perception based variables have been chosen. Second, data has been obtained from respected, public/ government or semi-government sources. Finally, periodically available indicators have been chosen.

These indicators have also been chosen after identifying the three channels through which institutions affect growth.

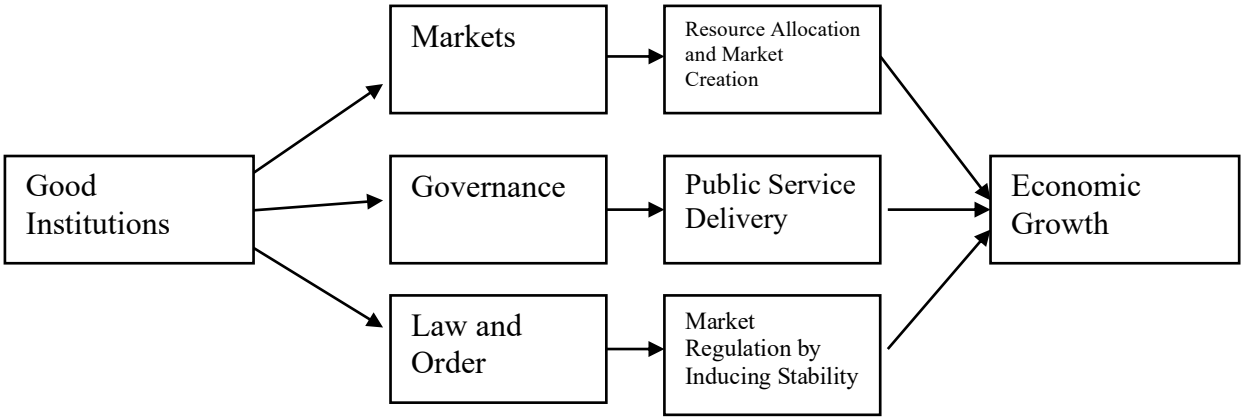


Figure 1 Channels linking Institutions with Economic Prosperity

World Bank has various institutional indicators like Political Stability, Voice and Accountability, Government Effectiveness (IMR, SSE, Education), Regulatory Quality (TnD losses, villages electrified), Rule of Law (crime against women and children, expenditure on police, recovery rate of stolen property) and Control of Corruption. This study uses proxy for these variables (as indicated in the brackets) as well as other indicators to account for institutional quality in a narrow, contemporaneous and formal fashion. These indicators alongwith their sources and summary statistics are presented in Table 1.

Now, a brief discussion is undertaken on how each sub-index of institutional quality channels into economic development and growth.

Index of Economic Efficiency

For constructing the Index of Economic Efficiency (IEE) using the factor analysis with principal component factoring, eight indicators have been used.

The first set of indicators is associated with electricity, which is found to be strongly correlated with economic development (Stern, Burke and Bruns, 2019). First is the transmission and distribution losses in the power sector. It measures the percentage of power generated that is lost during transmission and distribution. Kochhar et. Al (2006) argued that generation and distribution losses in power can be a proxy for the state level institutional quality because of two reasons. First, politicians turn a blind eye to power theft in a bid to derive electoral gains and also because of state level bureaucracy not working efficiently. However, the losses could depend other factors like the size of the informal sector, the level of poverty etc. and should therefore be taken

not as conclusive indicator but illustrative at best. Second is the proportion of villages electrified in a state. This becomes important especially in light of the implementation of Deen Dayal Upadhyay Grameen Ujjwala Yojana[3] in 2015. Due to efficiency of state level institutions, the proportion of electrified villages shot up after 2015. Per capita availability of power measured in kilowatt per hour is the third indicator. Electricity is a quasi-public good and is generally provided by the state (refer to Table A1). Thus, availability of power is also reflective of how successful the state is in providing an important good such as electricity to the general public and can therefore be taken as an indicator of institutional quality.

Table 1: Descriptive Statistics and Expect Relationship with PCI

Variable	Source	Mean	Std. Dev.	Min	Max	Expected Relation with PCI
Variables for Economic Efficiency Index						
Electricity						
T&D Losses	RBI	25.15	10.461	10.2	61.8	Negative
% of Villages Electrified	EPWRF	98.16	3.749	78.9	100	Positive
Per Capita Power Availability	RBI	959.71	499.74	108.5	2002.7	Positive
Infrastructure						
Road Mileage	RBI	.035	.012	.014	.064	Positive
Financial Development						
Bank Branches per Capita	RBI	.12	.048	.044	.216	Positive
Urban to Rural Bank Credit Ratio	RBI	8.52	29.426	.111	250.55	Positive
Urban to Rural Bank A/c Ratio	RBI	1.33	3.81	.052	24.024	Positive
Credit Deposit Ratio of State Banks	RBI	0.626	0.271	0.252	1.226	Positive
Variables for Governance Capacity Index						
Human Development Index	UNDP	0.632	0.059	0.52	0.775	Positive
Infant Mortality Rate	RBI	34.54	11.57	10	59	Negative
Per Capita						
Social Sector Expenditure	RBI	7793	3094	2078	17468	Positive
Water Sanitation Expenditure	EPWRF	452	383	51.6	2122	Positive
Education Expenditure	EPWRF	3088	1249	972	8351	Positive
Variables for Law and Order Index						
Crime Against Women and Children	NCRB	17608.7	13932	1079	75156	Negative
Per Capita Expenditure on Police	EPWRF	777	574.9	5.89	3470.89	Positive
Recovery Rate of Stolen Property	NCRB	32.08	16.75	1.6	77.8	Positive
Control Variables						
Urbanization Level	MoHFW	33.84	18.77	10.04	98.78	
Investment Rate	RBI	.426	.338	.093	1.97	
Dependent Variables						
Per Capita Income	EPWRF	97598.8	50191.8	23525	281172	
Per Capita Income Growth Rate	EPWRF	5.77	3.34	-8	16	
N=147						

Another indicator of economic institutions is the road mileage, defined as the national highways per area to capture the presence of infrastructure in a particular state. While the length of highways does not speak of their quality, roads mileage does give a glimpse of how congested

[3] Deen Dayal Upadhyay Gram Jyoti Yojana is a GoI scheme launched in 2015 designed to provide continuous electricity supply to rural India The scheme replaced Rajiv Gandhi Grameen Vidyutikaran Yojana.

the roads are. Lesser is the value of indicator, the more is the congestion, the less is the connectivity and eventually lower is the quality of travel and hence institutions of economic efficiency.

Finally, indicators on financial institutions are included. Benhabib and Spiegel (2000) use financial development as an indicator of institutional quality and find a significant and positive impact on economic development. The intertemporal nature of financial transactions makes it one of the most "institution-sensitive" sectors. A financial system can only thrive in an environment with effective institutions that reduce agency conflicts between contract parties (Beck, 2020)

Literature also suggests that financial deepening is a byproduct of institutional development as financial deepening does not happen in an institutional vacuum. Thus, financial development is not a police variable in itself but result of institutions, among other factors. Further, the outreach of the financial system and its impact on economic development as measured by per capita branch, increases in governance and trust, as this will allow financial system to percolate down to lower income population segments and small and medium sized enterprises. Third, an effective financial system can also improve other institutions, by increasing say fostering entrepreneurship, with ultimate positive repercussions for economic development. (Beck, 2020)

Increase in credit deposit ratio indicates formalization of financial markets, which in turn can lead to development of institutions as the nature and terms of interaction between creditors and depositors change. Further, new institutions get created. Example: to increased disbursement of agricultural credit, new institutions with more formal work culture like Agricultural Refinance and Development Corporation, rural branch network of SBI etc. came up. (Angadi, 2003)

Index of Governance Capacity

For constructing the Index of Governance Capacity (IGC), five indicators have been used. First is the Human Development Index. States such as Kerala have a higher HDI score in all the sample years. The established wisdom also suggests that the health and educational institutions in Kerala are qualitatively superior as the state governments put excess thrust on the same (Sen and Dreze, 2011). Stryzhak (2019) finds a strong and direct interconnection between HDI and World Governance Indicators- a measure of institutional quality. While HDI may be impacted by several other factors, it is safe to assert that it is an indicator of state's governance capacity.

Kouassi, A.E., Kouassi, Y.A.G., and Amanzou, N.A.A. (2021) find a positive and significant relationship between Infant Mortality Rate (IMR) and public health expenditure. This study also captures the role that institutional quality can play. i.e., they find that in the absence of institutional variables, public health expenditure has a negative and significant impact on IMR. Thus, lower values of IMR itself may be deemed as a consequence of better health institutions and thus be used as a proxy for the same. As IMR is negative associated with per capita income, its inverse is taken while constructing the index.

Finally, good governance, a measure of institutional quality also suggests strong government capacity to allocate resources. In other words, state governments with enough resources can improve the capita market and investment climate, stabilize the bureaucratic system and provide public services like medical treatment and education, which eventually facilitates economic growth (Lin, 2014), resulting in strengthening the "helping hand" of government power. Providing public services, providing quasi-public goods or public goods, and intervening to improve the functioning of markets are all directly concerned with resource allocation. (Vijayraghvan and Ward, 2011). Besley and Pearson argue that strong states have strong fiscal capacity and spend more on providing public goods.

Barro (1991) used public investment and government consumption in the share of GDP as a measure of institutions to study the impact on economic development. He found the impact to be positive and negative in a statistically significant respectively.

The sectors such as water sanitation, education and other social sectors demand a long-term budgetary commitment due to long gestation period. These sectors are heavily underfinanced as has been argued by many Parliamentary committees themselves. Thus, the allocation to these

sectors can be an indicator of policy and financing decisions on the one hand but also of institutional weaknesses or preferences on the other (Estache, 2020).

A special note on expenditure on social services is needed. It includes both revenue as well as capital expenditure and comprises of education, health, family welfare, water supply and sanitation, housing, welfare of the marginalized, urban development, social security and welfare, and labour welfare. By similar logic, the fourth and fifth indicators, i.e., the per capita expenditure on water sanitation and education respectively, are included in the analysis.

Index of Law and Order

Rule of law weakens rent seeking activities and promotes certainty by enabling/ enhancing the environment of safety and security for its citizens. Here, the index is constructed using three indicators. One is the crime against women and children. It can be deemed to have a negative relation with the state of law and order. It may be noted that higher reporting may also be due to higher levels of education and increased level of anonymity in say cities like Delhi. Further, cultural factors are at play. Similarly, per capita expenditure on police is also used as an indicator. Higher expenditure is indicative of the importance it places on maintaining law and order. However, Naxal infested states or insurgency infested states may be taken as an exception. It may be noted that the expenditure on police is just revenue expenditure

The bigger picture is that businesses operating in those states feel secure enough to carry their operations and make investment plans.

Finally, recovery rate of stolen properties may also be used as an indicator of quality of investigation and thus the institutions maintaining law and order. Personal security and security of claims to property are thought to be a basic driver of investment and development (Haggard et. al 2008). The protection of property rights, property and rule of law can be seen as a function of legal institutions. (Bo and Finan, 2020).

Studies such as Dollar and Kraay (2003), and Rodrik, Subramanian and Trebbi (2004) have used Rule of Law as a measure of institutions to study their impact on economic development and found the relation to be positive and statistically significant.

Methodology

Institutions are multi-dimensional. However, owing to the strong correlation among indicators, the risk of multi-collinearity statistically limits the use of diverse indicators in a single regression framework (Moers, 1999). Further, there is high degree of complementarity among the variables. To address this issue, several studies have resorted to different methodologies, specification and techniques.

Factor Analysis-Methodology

This study chooses exploratory factor analysis to explain the variance in the collated dataset while summarizing the underlying correlation structure[4]. For each index, combined factor analysis for seven years is undertaken with principal component factoring method. The first factor has maximum variance and successive factors explain progressively smaller portions of the variance but are uncorrelated with each other. Eigenvalues represent the standardized variance accounted for by a factor. To decide on the number of factors to be retained, criteria suggested by Kaiser (1974) is followed. He recommends dropping factors with an Eigenvalue smaller than one. Later,

[4] Harman (1976), Gorsuch (1983)

a rotation procedure is followed that distributes factor loadings evenly among the factors using Equamax method[5] with Kaiser normalization.

The factor loadings (weights) obtained are then used to interpret the factors. The weights indicate relative importance of each indicator with respect to each factor. A loading is the correlation between observed variables and factors: higher loading means that the indicator is more relevant in defining the factor. The indicators having negative values associated with the loadings indicate an inverse impact on the factor. That is, an inverse scale where the value is associated with better performance.

It may be noted that adequate measures were taken to ensure that factor analysis was a justified methodology here. This study tested the evidence of correlation using Bartlett's test of sphericity with the null hypothesis that the correlation matrix is an identity matrix (no correlation). The statistic is based on a chi-squared transformation of the determinant of the correlation matrix. Further, Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy is used to indicate the degree to which data is suitable for common factor analysis. The higher values indicate greater suitability to be combined in a common factor but the value should not be less than 0.5 in order to proceed with the analysis. In all the indices, we rejected the null hypothesis under the Bartlett's test of sphericity, implying that indicators are well suited for factor analysis. Similarly, in all the indices, the KMO measure was greater than 0.5. Finally, the indices have been re-scaled using an intercept such that they have a positive range between 0 and 1. The closer is the value to 1, higher is the quality of institutional variable.

Indices: Analysis

This section talks about how each index is constructed using the methodology discussed above.

Index of Economic Efficiency (IEE)

A combined factor analysis was performed wherein three factors were retained. They explained almost 75% of the total variance of the dataset. Without rotation, the first factor explained on average 40.47% of 78% of variance. After rotation, the first factor explained on average 26.32% of the 78% of the total variance and the two other factors explained 25.02% and 23.84% of the retained variance respectively.

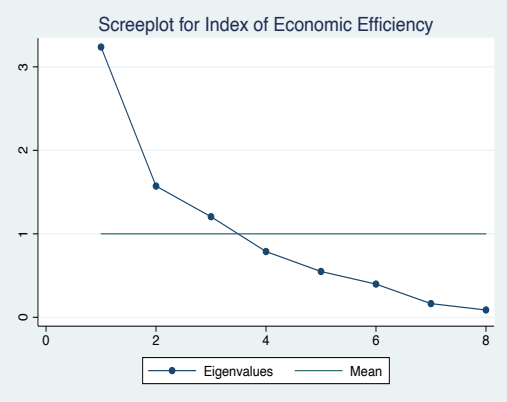


Table 2: Indicators for Index of Economic Efficiency and their Factor Loadings (rotated, unrotated)

Variable	Factor1	R_Factor1	Factor2	R_Factor2	Factor3	R_Factor3	Uniqueness
Per Capita Power Availability	0.792	0.248	0.221	0.652	0.178	0.470	0.292
Road Mileage	0.436	0.244	-0.360	0.751	0.656	-0.356	0.250
T&D Losses (Inverse)	0.429	0.003	0.513	0.117	-0.251	0.705	0.489
% of Villages Electrified	0.582	-0.010	0.454	0.484	0.105	0.567	0.444
Urban to Rural Bank Account Ratio	0.688	0.960	-0.620	0.146	-0.297	0.046	0.054
Urban to Rural Bank Credit Ratio	0.659	0.962	-0.624	0.097	-0.337	0.048	0.062
Per Capita Branch	0.769	0.175	0.136	0.856	0.469	0.257	0.171
Credit Deposit Ratio of state banks	0.632	0.326	0.364	0.041	-0.496	0.819	0.222
Kaiser Meyer Olkin Measure of Sampling Adequacy		0.614					
Bartlett's Test of Sphericity	Chi Square	597.3					
	Sig.	0					

R_Factor(i) are the factor loadings of Factor i after rotation using equamax method with Kaiser normalization
Uniqueness is the variance that is not explained by the factors.

[5] Equamax method is a combination of the Varimax and Quartimax method. The first simplifies the interpretation of the factor by maximizing the variances of the variable loadings on each factor, and the second simplifies the interpretation of the observed variables by finding a rotation that produces high and low loadings across factors for each variables, hence minimizes the number of factors needed to explain each variables.

Later, these values were used as weights when combining the three factors into an index. The resulting index captures large parts of cross-state variation in the quality of economic institutions.

This IEE fuels growth through the channels of market regulation and resource allocation. When infrastructure is strengthened- be it financial, power or connectivity, markets get concretized.

Index of Governance Capacity (IGC)

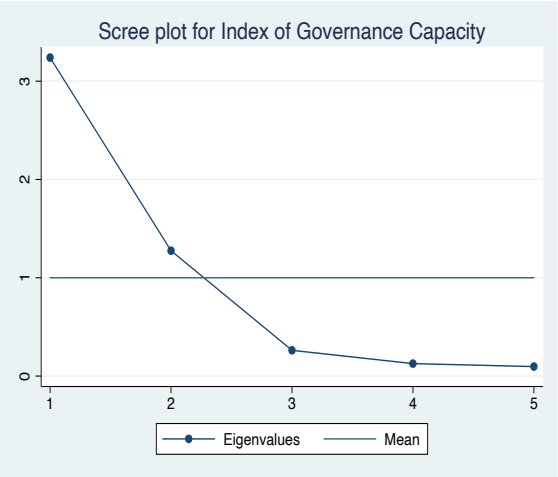
A combined factor analysis was performed wherein two factors were retained. They explained almost 90% of the total variance of the dataset. Without rotation, the first factor explained on average 64.8% of 90% of variance. After rotation, the first factor explained on average 48.8% o and the other factor explained 41.5% of the retained variance. Later, these values were used as weights when combining the two factors into an index.

Table 3: Indicators for Index of Governance Capacity and their Factor Loadings (rotated, unrotated)

Variable	Factor1	R_Factor1	Factor2	R_Factor2	Uniqueness	R_Uniqueness
HDI	0.842	0.363	0.446	0.881	0.090	0.090
Inverse of IMR	0.576	-0.057	0.784	0.971	0.053	0.053
Per Capita						
Social Sector Expenditure	0.888	0.849	-0.259	0.367	0.144	0.144
Water Sanitation Expenditure	0.715	0.934	-0.602	0.006	0.126	0.129
Education Expenditure	0.947	0.842	-0.176	0.468	0.071	0.071

Kaiser Meyer Olkin Measure of Sampling Adequacy		0.703
Bartlett's Test of Sphericity	Chi Square	620.698
	Sig.	0

R_Factor(i) are the factor loadings of Factor i after rotation using equamax method with Kaiser normalization
Uniqueness is the variance that is not explained by the factors.



Index of Law and Order (ILO)

A combined factor analysis was performed wherein one factor was retained. With or without rotation, the factor explained almost 53.5% of the total variance of the dataset. The retained factor is the Index of Law and Order[6].

Index of Institutional Quality

Finally, IIQ was calculated as an average of the three indices with equal weights. The indices are Index of Governance Capacity (IGC), Index of Law and Order (ILO) and Index of Economic Efficiency (IEE). Then, they all were rescaled such that they range from 0 to 1.

[6] The obtained factor loadings for this index indicators are not reported here in interest of space.

The summary statistics of all the indices are given in Table 4. Higher the value of the index, the better is the quality of institutions.

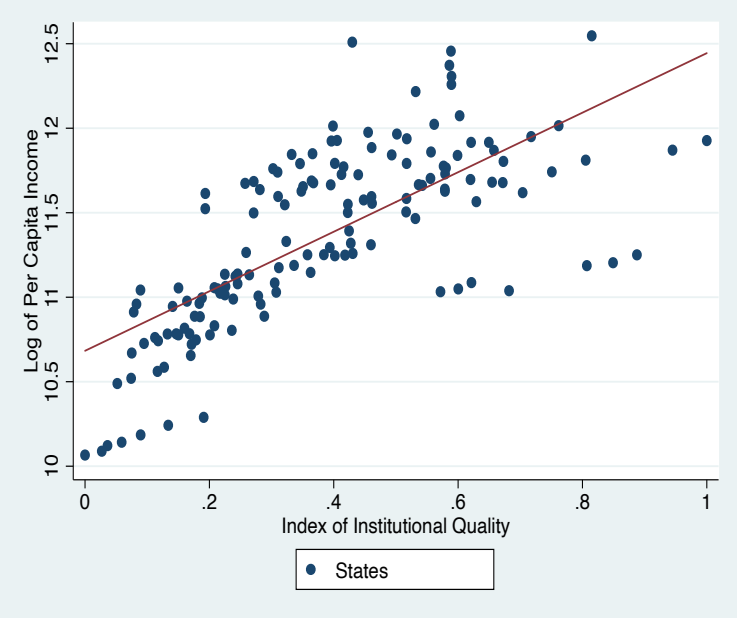


Figure 2 Index of Institutional Quality and Income Comparison

Figure 2 plots the relationship between IIQ and log of per capita income. There seems to be a direct relation between the two. Whether it is correlation or causation becomes the topic for the second stage of analysis of this study.

Empirical Analysis

Through this section, the study aims to understand the impact of institutional quality on per capita income its growth rate, using pooled OLS and FE based panel data estimation method.

Data Description
This analysis is based on 7-year period covering 2011-2017 for 21 states of India. The dependent variables are log of per capita income and year on year per capita income growth. For the independent variables, there are institutional variables and control variables like investment to SDP ratio, level of urbanization and human capital. Their sources alongwith description are stated in Table 4. To measure institutional dimensions, the IIQ as well as sub-indices like ILO, IGC and IEE are considered.

Pooled OLS Regression Specification
This study assesses the level and growth impact of institutional quality on per capita income of Indian states. The specification is:

$$y_{it} = \beta_0 + \beta_1 X_{it} + \beta_2 I_{it} + \beta_3 I_{it-1} + T_i + \in_{it}$$

Here, subscript '*i* ' represents States of India while 't' represents time. '*y*' is the dependent variable- log of per capita income and growth of per capita income year on year respectively. 'I' stands for institutional variables, T_i are time dummies capturing economic shocks and $\in$ is the error term. It

is assumed that institutions impact income with a lag and thus lags of institutional indices are also included.

Table 4: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Annual PCI Growth Rate	126	5.77	3.34	-8	16
Log Per Capita Income	147	11.36	.53	10.07	12.55
Investment to GDP ratio	147	.43	.34	.09	1.97
Level of Urbanization	147	33.84	18.78	10.04	98.78
Human Capital	147	0.543	0.067	0.420	0.725
IIQ	147	.36	.21	0	1
Sub-Indices					
IGC	147	.3	.17	0	1
IEE	147	.15	.15	0	1
ILO	147	.35	.22	0	1

Number of States: 21
Number of Years: 7

Fixed Effects Based panel estimation Methodology
Similarly, the same regression specification is used for estimation in a fixed effects set-up

$$y_{it} = \beta_0 + \beta_1 X_{it} + \beta_2 I_{it} + \beta_3 I_{it-1} + T_i + S_i + \in_{it}$$

Here, T and S are time dummies capturing common shocks to states across years and state specific fixed effects, respectively. For the growth regression, lag of log per capita income is also included as a regressor.

Other controls as specified by 'X' are potential determinants of income. However, the literature is rather divided on what is the ideal set of control variables here. Levine and Renelt (1992) identified more than 50 variables that could be used as controls in regression models. This study includes level of urbanization level, investment and human capital as the key determinants of income.

Investment is represented by Gross Fixed Capital Formation as a percentage of State Domestic Product. The *apriori* expected sign is positive as higher the investment, higher is the production capacity, which translated into higher income (Maddison, 1992; Carroll and Weil, 1994). Another control variable is level of urbanization. It is taken as a proxy for trade liberalization and openness as evidence from economics of geography suggests that greater urbanization leads to an increased level of trade due to agglomeration effects (Thia, 2015). Final control is human capital as it also influences growth by fostering innovation. In growth empirics, educational attainment is generally used as a proxy of human capital. This study uses a sub-indices of the HDI for the same.

Results

The pairwise correlation coefficient matrix for key variables in the regression equation is given in Table 5. SDP per capita has significant and positive correlation with investment and rate of urbanization. Both the per capita income as well as the annual income growth rate are positively correlated with investment, urbanization and quality of institutions. This may mean that high income states also have well-developed and quality institutions.

As the main thrust of this study is to understand the nexus between institutions and economic development and growth, the results reported are for two independent variables.

Table 5: Correlation Coefficient Matrix

Variables	Per Capita Income	Annual PCI growth	Investment Ratio	Urbanization Level	IIQ	IGC	IEE	ILO
Per Capita Income	1.000							
Annual PCI growth	0.277*	1.000						
	(0.001)							
Investment Ratio	0.512*	0.505*	1.000					
	(0.000)	(0.000)						
Level of Urbanization	0.711*	0.717*	0.820*	1.000				
	(0.000)	(0.000)	(0.000)					
Index of Institutional Quality	0.714*	0.708*	0.220*	0.324*	1.000			
	(0.000)	(0.000)	(0.007)	(0.000)				
Index of Governance Capacity	0.774*	0.771*	0.247*	0.371*	0.911*	1.000		
	(0.000)	(0.000)	(0.003)	(0.000)	(0.000)			
Index of Economic Efficiency	0.706*	0.707*	0.836*	0.848*	0.478*	0.451*	1.000	
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)		
Index of Law and Order	0.137*	0.143	-0.358*	-0.291*	0.696*	0.446*	-0.171*	1.000
	(0.099)	(0.111)	(0.000)	(0.000)	(0.000)	(0.000)	(0.039)	

**** p<0.01, ** p<0.05, * p<0.1*

Table 6: Institutions and Income: Pooled OLS and FE Estimation

	Dependent Variable: Log of Per Capita Income									
	(1) POLS	(2) FE	(3) POLS	(4) FE	(5) POLS	(6) FE	(7) POLS	(8) FE	(9) POLS	(10) FE
IIQ	.25**	.13***								
	(.1)	(.03)								
IIQ (-1)	.25**	.17***								
	(.1)	(.06)								
IGC			.2**	.09***	.21*	.08***				
			(.1)	(.02)	(.11)	(.02)				
IGC (-1)			.21*	.13***	.23*	.12***				
			(.11)	(.02)	(.12)	(.03)				
ILO			-.07	-.04			.12	.04		
			(.09)	(.03)			(.12)	(.04)		
ILO (-1)			-.08	-.01			.1	.04		
			(.09)	(.03)			(.11)	(.04)		
IEE			-.01	-.01					.19***	.01
			(.07)	(.01)					(.07)	(.03)
IEE (-1)			-.07	-.01					0.31**	-.02
			(.08)	(.01)					(.12)	(.04)
Constant	10.53***	10.91***	10.67***	10.83***	10.6**	10.94***	10.28***	10.49***	10.85***	10.25***
	(.07)	(.58)	(.08)	(.44)	(.06)	(.44)	(.08)	(.67)	(.17)	(.63)
Observations	126	126	126	126	126	126	126	126	126	126
R-squared	.82	.77	.88	.85	.87	.85	.71	.68	.64	.67
State FE		Yes		Yes		Yes		Yes		Yes
Time Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors are in parentheses
The regressions control for investment, urbanization and human capital. The coefficients have expected signs but mostly insignificant.
**** p<.01, ** p<.05, * p<.1*

Table 6 shows results with dependent variable being the log of per capita income. It has results using both the methods: pooled OLS as well as fixed effects method. All models include (t-1) period dummy variables to account for fixed time effects. In Model (1), a pooled OLS shows that institutions affect the per capita income contemporaneously as well as with a lag. Model (3) captures the individual impact of each sub-component of institutions. Here, it is the IGC that positively and significantly affect the per capita income, contemporaneously as well as with a lag, while others are insignificant. Models (5), (7) and (9) are other specifications reported to capture the individual impact of each component.

The other results relating to human capital, investment and urbanization also need to be discussed. The coefficients of are in line with economic theories and intuitions and most of them are statistically significant.

Table 7: Institutions and Income Growth: Fixed Effects based Estimation

Dependent Variable: Annual Per Capita Income Growth Rate					
	(1)	(2)	(3)	(4)	(5)
Per Capita Income (-1)	-12.29	-19.27*	-20.37*	-5.98	-5.61
	(8.35)	(10.42)	(10.17)	(6.8)	(6.53)
IIQ	.5				
	(1.96)				
IIQ (-1)	6.09**				
	(2.52)				
IGC		3.9**	3.67**		
		(1.67)	(1.64)		
IGC (-1)		1.73	1.75		
		(1.48)	(1.48)		
ILO		-3.09		-1.81	
		(1.62)		(1.55)	
ILO (-1)		2.01		3.37*	
		(1.71)		(1.68)	
IEE		-.22			-.19
		(.43)			(.4)
IEE (-1)		1.23*			1.32*
		(.64)			(.74)
Constant	137.33	208.96*	222.99*	61.93	54.13
	(92.96)	(115.18)	(112.83)	(74.08)	(67.82)
Observations	126	126	126	126	126
R-squared	.13	.19	.15	.11	.08
State FE	Yes	Yes	Yes	Yes	Yes
Time Dummies	Yes	Yes	Yes	Yes	Yes

Robust standard errors are in parentheses
The regressions control for investment and human capital. The coefficients are insignificant.
**** p<.01, ** p<.05, * p<.1*

However, pooled OLS estimation may be biased and inconsistent if there's unobserved heterogeneity which is correlated with other regressors. Thus, a FE model is fitted as well. Model (2) is a FE model which confirms the pooled OLS results. Further, even in FE estimation, the Index of Governance Capacity is significant (see Model (4)). Finally, Model (6), (8) and (10) capture the individual effects of each sub-index.

A note on using time fixed effects is in order. The sample size for this study is only 126 observations with 7 years of data. Thus, specifying fixed effects for each year separately consumes more degrees of freedom. To address this problem, the study period is divided into two blocks wherein years where there was a common economic shock to all states are clubbed into one.

Table 7 shows FE based estimation results with annual per capita income growth rate as the dependent variable. Quality institutions impact the growth with a lag. Of the institutions that matter, IGC and IEE both have a positive and significant impact on growth.

Conclusion

Institutions indeed are important. However, the limited literature is divided on what constitutes them. This study looks at institutions from a more contemporaneous lens than looking at variables that change over long-time horizons. To the best of author's knowledge, there was also no sub-national study that looked at the impact of institutional quality on state level income growth rates in India. Further, while there are multiple studies looking at unique sub-components of institutions, there is lack of studies that look at a holistic index of institutional quality spanning economic efficiency, governance capacity and law and order.

This study investigated the level and growth effects of institutions on income by constructing a novel Index of Institutional Quality, comprising of three sub-components- Index of Law and Order, Index of Economic Efficiency and Index of Governance Capacity. The period of the study is 2011-2017 for 21 Indian states. The indices were constructed using factor analysis with principal component factoring method.

Overall, results of panel OLS and fixed effects estimation suggest that institutions play an important role in explaining income growth of Indian states, in the short run.

From a policy perspective, this study has few prescriptions. First, institutional quality indeed matters even in the short run. They have a level as well as growth effect. Thus, a nation should keep striving to better them. Second, among the institutions that matter, it is the economic institutions that drive the impact the most. This is expected as well. In an emerging market economy with a vast demographic dividend such as India, it is the nurturing of economic institutions that can have significant and long-lasting impact on long term growth. There have been debates on whether countries should develop institutions first and then develop later or this can happen simultaneously. This study is an attempt to suggest that in the short run, both kinds of developments can happen simultaneously. Strengthening the economic infrastructure and associated structure should therefore be the low-hanging fruits that India as a nation can aim for in the coming few years and initiate smart institutional reforms.

A few caveats are in order. First, The results might change depending on how the institutions are defined. Only a few institutions are covered in this paper. They, however, are not an exhaustive representation of the multiplicity of institutions in India. This limitation magnifies when we think of informal institutions. Thus, the evidence is meant to be illustrative and not conclusive (Subramanian, 2007). Second, it may be interesting to repeat the exercise over a longer time horizon and with a wider set of indicators of institutional quality like property rights, corruption, ease of doing business, quality of education and finally include time fixed effects in the model. Finally, the fixed effects model addressed endogeneity of one form but not reverse causality. Owing to data limitation, these remains outside the scope of this paper.

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Appendix

Table A1: Indicators and Their Classification under Seventh Schedule of Indian Constitution

Variable	Classification under Seventh Schedule
Indicators for Economic Efficiency Index	
T&D Losses	Concurrent
% of Villages Electrified	Concurrent
Per Capita Power Availability	Concurrent
Road Mileage	Concurrent
Bank Branches per Capita	Centre and State
Urban to Rural Bank Credit Ratio	Centre and State
Urban to Rural Bank A/c Ratio	Centre and State
Indicators for Governance Capacity Index	
Human Development Index	State and Concurrent
Infant Mortality Rate	Concurrent
Per Capita	
Social Sector Expenditure	State
Water Sanitation Expenditure	State
Education Expenditure	Concurrent
Indicators for Rule of Law Index	
Crime Against Women and Children	State
Per Capita Expenditure on Police	State
Recovery Rate of Stolen Property	State

Table A2: Scoring Coefficients of the Factors for the Three Indices

Variable	Factor1	Factor2	Factor3
Index of Economic Efficiency			
Per Capita Power Availability	-0.011	0.280	0.152
Road Mileage	0.019	0.487	-0.360
T&D Losses (inverse)	-0.063	-0.051	0.401
% of villages electrified	-0.128	0.205	0.255
Urban to Rural Bank Account Ratio	0.500	-0.092	-0.056
Urban to Rural Bank Credit Ratio	0.510	-0.124	-0.046
Per Capita Branch	-0.076	0.458	-0.007
Credit Deposit Ratio of state banks	0.123	-0.178	0.463
Index of Law and Order			
Crime against Women and Children (inverse)	0.456		
Per Capita Expenditure on Police	0.486		
Recovery Rate of Theft	0.422		
Index of Governance Capacity			
HDI	-0.023	0.435	
Inverse of IMR	-0.255	0.586	
Per Capita			
Social Sector Expenditure	0.340	0.018	
Water Sanitation Expenditure	0.471	-0.222	
Education Expenditure	0.313	0.079	

-Scoring coefficients based on equamax rotated factors

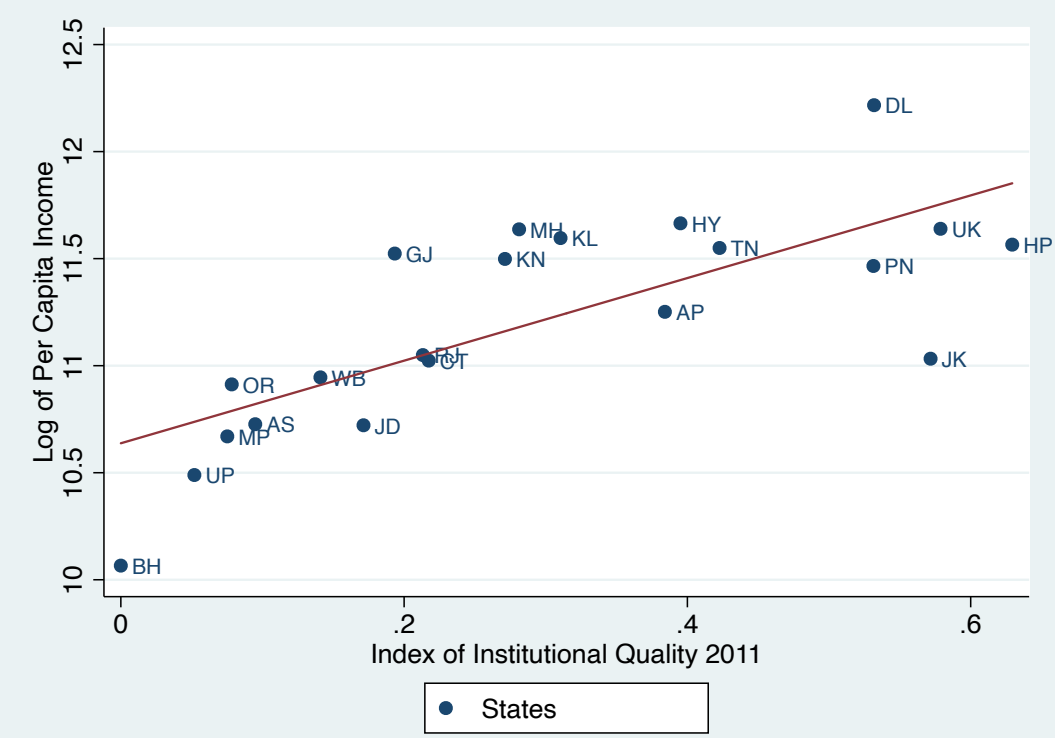
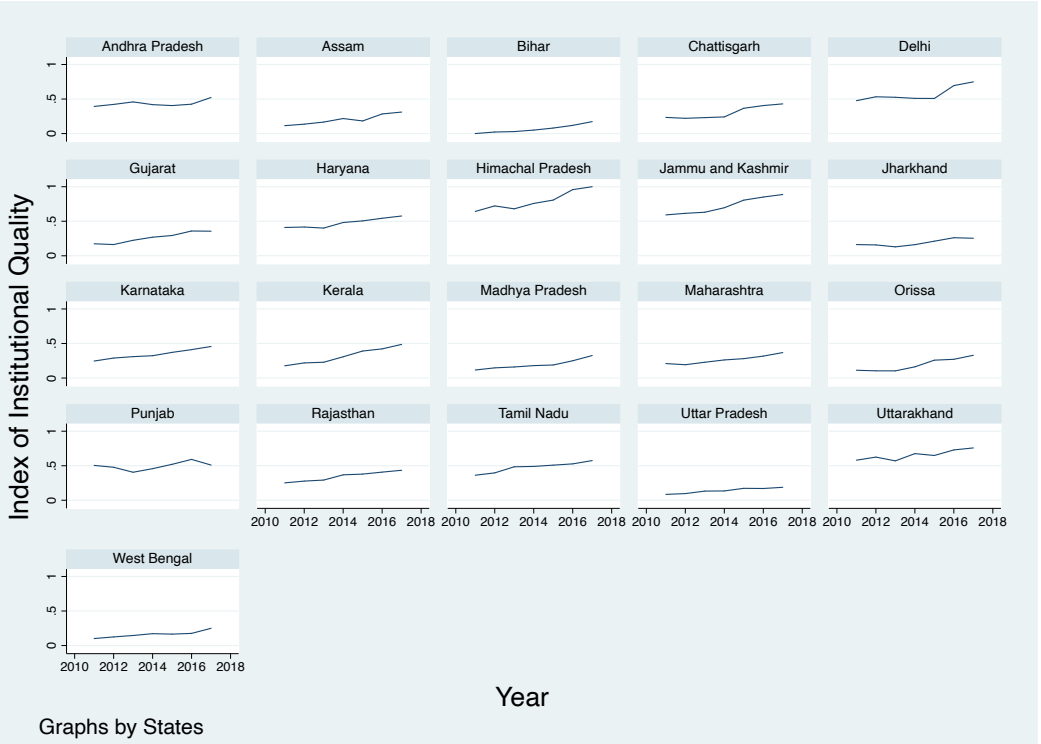


Fig A1 Institutions and Income in 2011

Fig A2 Institutions and Income in 2017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Orissa
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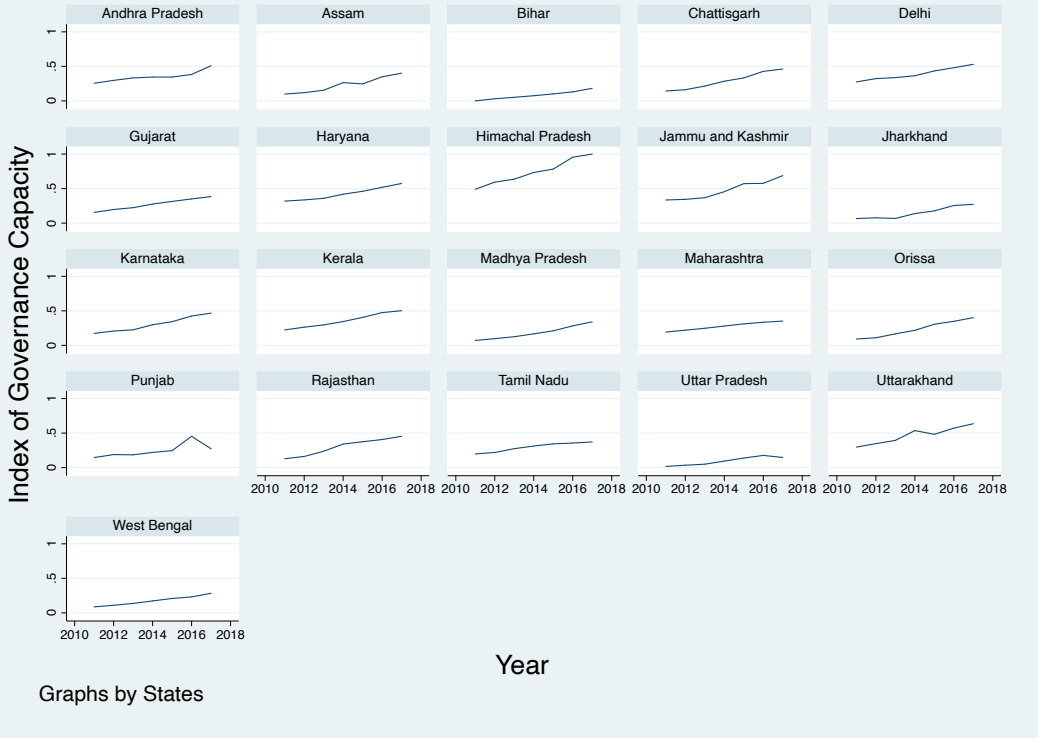
Graphs by States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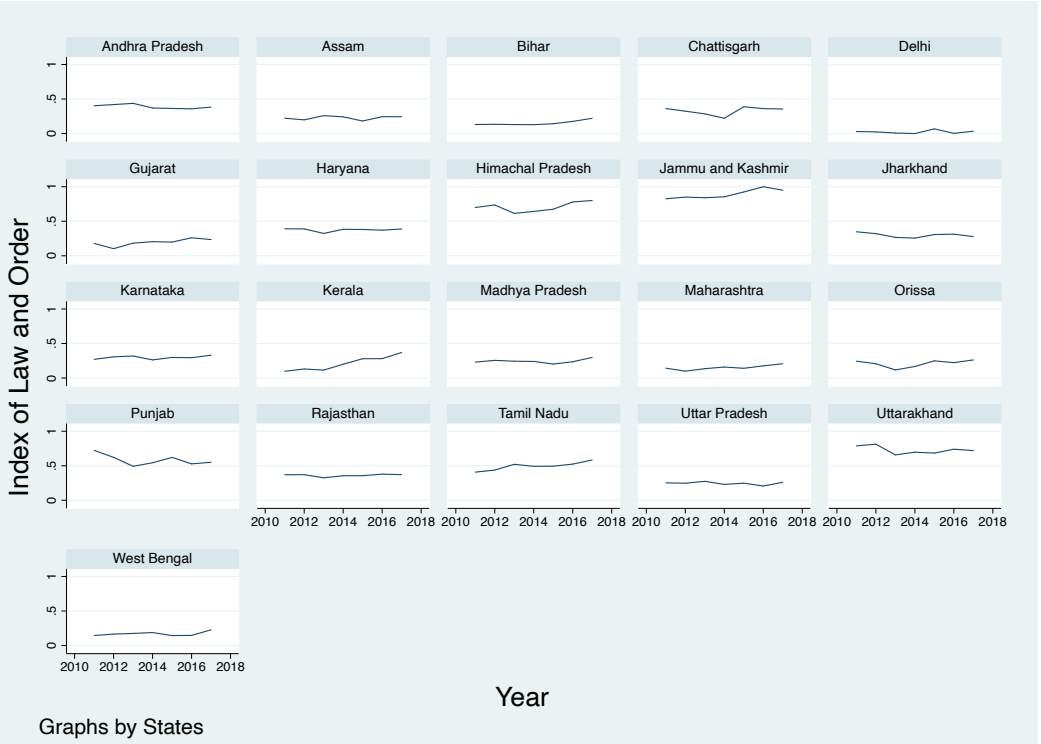
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Year
Graphs by States


Andhra Pradesh
Assam
Bihar
Chattisgarh
Delhi
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Haryana
Himachal Pradesh
Jammu and Kashmir
Jharkhand
Karnataka
Kerala
Madhya Pradesh
Maharashtra
Orissa
Punjab
Rajasthan
Tamil Nadu
Uttar Pradesh
Uttarakhand
West Bengal
Index of Economic Efficiency
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2010 2012 2014 2016 2018
Year
Graphs by States

Index of Institutional Quality

		States	2011	2012	2013	2014	2015	2016	2017
0.7954	1	Himachal Pradesh	0.6421	0.7226	0.6799	0.7581	0.8068	0.9582	1.0000
0.7252	2	Jammu and Kashmir	0.5917	0.6147	0.6306	0.6958	0.8056	0.8507	0.8872
0.6552	3	Uttarakhand	0.5803	0.6252	0.5707	0.6754	0.6482	0.7287	0.7580
0.5181	4	Delhi	0.4759	0.5324	0.5250	0.5095	0.5081	0.6942	0.7485
0.4953	5	Punjab	0.5045	0.4776	0.4058	0.4577	0.5203	0.5915	0.5097
0.4777	6	Tamil Nadu	0.3627	0.3967	0.4843	0.4904	0.5083	0.5270	0.5745
0.4762	7	Haryana	0.4097	0.4166	0.4010	0.4820	0.5053	0.5430	0.5760
0.4349	8	Andhra Pradesh	0.3928	0.4218	0.4581	0.4187	0.4054	0.4254	0.5221
0.3444	9	Rajasthan	0.2518	0.2775	0.2923	0.3684	0.3789	0.4077	0.4343
0.3440	10	Karnataka	0.2461	0.2893	0.3098	0.3231	0.3714	0.4113	0.4568
0.3188	11	Kerala	0.1768	0.2190	0.2286	0.3071	0.3911	0.4220	0.4870
0.3037	12	Chhattisgarh	0.2336	0.2206	0.2307	0.2405	0.3658	0.4052	0.4297
0.2655	13	Maharashtra	0.2091	0.1928	0.2286	0.2618	0.2805	0.3172	0.3684
0.2626	14	Gujarat	0.1736	0.1627	0.2243	0.2691	0.2938	0.3586	0.3561
0.2015	15	Assam	0.1142	0.1359	0.1660	0.2174	0.1823	0.2837	0.3111
0.1954	16	Madhya Pradesh	0.1161	0.1471	0.1600	0.1797	0.1890	0.2501	0.3257
0.1917	17	Orissa	0.1129	0.1042	0.1036	0.1622	0.2588	0.2710	0.3294
0.1911	18	Jharkhand	0.1624	0.1574	0.1293	0.1610	0.2116	0.2618	0.2541
0.1621	19	West Bengal	0.1013	0.1250	0.1455	0.1723	0.1654	0.1758	0.2498
0.1401	20	Uttar Pradesh	0.0849	0.0970	0.1325	0.1351	0.1727	0.1704	0.1876
0.0674	21	Bihar	0.0000	0.0224	0.0283	0.0501	0.0797	0.1184	0.1727

Index of Governance Capacity

		States	2011	2012	2013	2014	2015	2016	2017
0.7415	1	Himachal Pradesh	0.4909	0.5934	0.6362	0.7332	0.7826	0.9541	1.0000
0.4771	2	Jammu and Kashmir	0.3352	0.3443	0.3682	0.4557	0.5719	0.5762	0.6881
0.4662	3	Uttarakhand	0.2965	0.3471	0.3942	0.5362	0.4823	0.5714	0.6358
0.4266	4	Haryana	0.3188	0.3364	0.3592	0.4187	0.4607	0.5183	0.5743
0.3918	5	Delhi	0.2745	0.3224	0.3371	0.3646	0.4339	0.4802	0.5299
0.3586	6	Kerala	0.2234	0.2634	0.2963	0.3450	0.4051	0.4748	0.5021
0.3526	7	Andhra Pradesh	0.2557	0.2974	0.3331	0.3454	0.3448	0.3825	0.5095
0.3056	8	Karnataka	0.1733	0.2075	0.2250	0.2986	0.3427	0.4249	0.4669
0.3005	9	Rajasthan	0.1291	0.1615	0.2369	0.3408	0.3747	0.4068	0.4537
0.2964	10	Tamil Nadu	0.1979	0.2192	0.2742	0.3122	0.3438	0.3555	0.3719
0.2896	11	Chhattisgarh	0.1434	0.1619	0.2149	0.2853	0.3324	0.4276	0.4615
0.2768	12	Maharashtra	0.1927	0.2196	0.2477	0.2798	0.3112	0.3348	0.3518
0.2717	13	Gujarat	0.1550	0.1975	0.2240	0.2763	0.3143	0.3504	0.3842
0.2444	14	Punjab	0.1457	0.1885	0.1852	0.2202	0.2456	0.4528	0.2725
0.2346	15	Orissa	0.0916	0.1099	0.1663	0.2185	0.3057	0.3485	0.4021
0.2335	16	Assam	0.0993	0.1195	0.1546	0.2641	0.2462	0.3494	0.4012
0.1851	17	Madhya Pradesh	0.0716	0.0975	0.1253	0.1673	0.2103	0.2831	0.3408
0.1760	18	West Bengal	0.0865	0.1105	0.1375	0.1732	0.2089	0.2315	0.2838
0.1508	19	Jharkhand	0.0663	0.0770	0.0679	0.1381	0.1782	0.2553	0.2725
0.0940	20	Uttar Pradesh	0.0177	0.0347	0.0494	0.0946	0.1384	0.1764	0.1469
0.0817	21	Bihar	0.0000	0.0309	0.0521	0.0747	0.1013	0.1308	0.1821

Index of Law and Order

Average	Rank	States	2011	2012	2013	2014	2015	2016	2017
0.8919	1	Jammu and Kashmir	0.8254	0.8497	0.8412	0.8539	0.9235	1.0000	0.9497
0.7277	2	Uttarakhand	0.7872	0.8122	0.6567	0.6963	0.6835	0.7394	0.7185
0.7064	3	Himachal Pradesh	0.6990	0.7357	0.6139	0.6423	0.6742	0.7795	0.8005
0.5824	4	Punjab	0.7223	0.6214	0.4919	0.5435	0.6209	0.5269	0.5499
0.4938	5	Tamil Nadu	0.4072	0.4372	0.5204	0.4918	0.4930	0.5235	0.5832
0.3907	6	Andhra Pradesh	0.4026	0.4196	0.4371	0.3698	0.3637	0.3580	0.3838
0.3754	7	Haryana	0.3907	0.3891	0.3238	0.3834	0.3813	0.3712	0.3882
0.3609	8	Rajasthan	0.3693	0.3709	0.3255	0.3554	0.3559	0.3785	0.3707
0.3281	9	Chhattisgarh	0.3616	0.3237	0.2846	0.2217	0.3882	0.3611	0.3556
0.2985	10	Jharkhand	0.3478	0.3203	0.2667	0.2559	0.3075	0.3135	0.2778
0.2972	11	Karnataka	0.2703	0.3066	0.3187	0.2626	0.2977	0.2943	0.3303
0.2452	12	Uttar Pradesh	0.2515	0.2469	0.2740	0.2297	0.2474	0.2064	0.2602
0.2437	13	Madhya Pradesh	0.2301	0.2559	0.2434	0.2404	0.2019	0.2357	0.2983
0.2272	14	Assam	0.2220	0.1982	0.2592	0.2415	0.1814	0.2443	0.2436
0.2104	15	Kerala	0.0975	0.1310	0.1146	0.1993	0.2797	0.2805	0.3701
0.2098	16	Orissa	0.2440	0.2068	0.1169	0.1674	0.2492	0.2225	0.2619
0.1948	17	Gujarat	0.1789	0.1034	0.1833	0.2040	0.1986	0.2609	0.2347
0.1705	18	West Bengal	0.1448	0.1659	0.1755	0.1881	0.1447	0.1468	0.2275
0.1517	19	Bihar	0.1309	0.1341	0.1299	0.1285	0.1417	0.1762	0.2209
0.1516	20	Maharashtra	0.1423	0.1001	0.1351	0.1590	0.1412	0.1765	0.2069
0.0237	21	Delhi	0.0296	0.0244	0.0072	0.0000	0.0678	0.0034	0.0338

Index of Economic Efficiency

Average	Rank	States	2011	2012	2013	2014	2015	2016	2017
0.7091	1	Delhi	0.7442	0.8092	0.7981	0.7470	.7978	.8562	0.9900
0.2213	2	Tamil Nadu	0.1957	0.2066	0.2286	0.2315	0.2316	0.2226	0.2327
0.2140	3	Punjab	0.1838	0.1960	0.2008	0.2086	0.2194	0.2416	0.2475
0.2099	4	Haryana	0.1777	0.1743	0.1909	0.2207	0.2240	0.2476	0.2342
0.2015	5	Maharashtra	0.1905	0.1765	0.1784	0.1831	0.2058	0.2137	0.2622
0.1910	6	Andhra Pradesh	0.1982	0.1923	0.2061	0.1899	0.1712	0.1766	0.2026
0.1655	7	Karnataka	0.1438	0.1524	0.1607	0.1698	0.1791	0.1737	0.1787
0.1551	8	Kerala	0.1441	0.1477	0.1495	0.1588	0.1711	0.1570	0.1573
0.1544	9	Gujarat	0.1216	0.1378	0.1429	0.1521	0.1659	0.1862	0.1742
0.1388	10	Himachal Pradesh	0.1131	0.1215	0.1259	0.1447	0.1527	0.1519	0.1618
0.1333	11	Uttarakhand	0.1018	0.1086	0.1221	0.1328	0.1507	0.1525	0.1643
0.1026	12	Rajasthan	0.0942	0.1081	0.1066	0.1126	0.0969	0.0945	0.1052
0.0865	13	West Bengal	0.0904	0.0882	0.0893	0.0900	0.0862	0.0804	0.0813
0.0794	14	Jammu and Kashmir	0.0418	0.0505	0.0655	0.0861	0.1014	0.1015	0.1092
0.0708	15	Chhattisgarh	0.0521	0.0485	0.0547	0.0681	0.0809	0.0866	0.1045
0.0620	16	**Madhya Pradesh**	0.0423	0.0473	0.0565	0.0539	0.0684	0.0737	0.0918
0.0489	17	**Uttar Pradesh**	0.0154	0.0259	0.0499	0.0555	0.0632	0.0632	0.0692
0.0410	18	Assam	0.0183	0.0649	0.0202	0.0240	0.0401	0.0599	0.0594
0.0396	19	Orissa	0.0000	0.0043	0.0414	0.0452	0.0523	0.0598	0.0741
0.0303	20	Jharkhand	0.0100	0.0188	0.0322	0.0315	0.0314	0.0412	0.0471
0.0222	21	**Bihar**	0.0000	0.0075	0.0013	0.0212	0.0364	0.0430	0.0459