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Full Length Research Article

Can Location Decisions of Firms Determine Growth Disparities among the States of India?

Waqar Ahmed*[1], Manisha Yadav[2] and Pintu Majhi[3]

[1,3] ICSSR Doctoral Research Fellow, Department of Economics, Tripura University (A Central University), Agartala - 799 022 Tripura, India
[2] Department of Economics, Central University of Haryana, Mahendergarh - 123 031, Haryana, India

Abstract

The government introduced the growth centres initiative in the early eighties to encourage the industrialization of underdeveloped areas. To help the states lure businesses, the growth centres offer the necessary industrial Infrastructure, such as power, water, telecom, and banking. This paper attempts to assess the role of firm location in determining the growth disparity in selected states of India. The principal aim of this study is to investigate the role of industrialization, patent application filled, gross enrollment ratio in higher education, financial credit and infrastructure development in explaining the disparities of economic growth among the states of India over the period 2004-2016. The empirical random-panel regression results of this study indicated that industrial concentration and industrial labour force participation positively influence the economic growth of the states of India. Therefore, the study's findings define the high variation in growth explained by industrial concentration. As per the result of the study, industrialization, patent application filled, gross enrollment ratio in higher education, financial credit, and infrastructure development have positive and significant associations with net state domestic product. However, the industrial concentration, density of highways and credit to the industries are the most affecting factors to determine the growth of these states.

***Key words*:** Net state domestic product, Industrialization, Gross enrollment ratio, Number of patents, Credit deposit ratio, Infrastructure development

Firms play an important role in the growth and development process of the economies. Though the role of firms in economic development differs between countries, every economy conceives the positive role of firms in the economy. A nation's competitiveness depends on the capacity of its industry to innovate and upgrade [1]. What makes the researchers and policymakers consider the manufacturing sector still an engine of growth is not only its direct bearing on the overall socio-economic development of a nation but also how the vertical and horizontal expansion of this sector affects other sectors, capital accumulation, forward and backward linkages, structural transformation bonus, technological transformation and utilizing the labour market at optimum level.

India can be regarded as one of the few economies in the developing world that have been 'success stories' of globalization [2]. The economic reforms initiated by the government of India in 1991, along with the wave of globalization, have rapidly unshackled the Indian economy and placed it on a strong path of economic growth. The desperate and innovative sectors like information technology and pharmaceuticals have successfully reaped the benefits arising from reforms. Though a lot is desired from the potential manufacturing sector, it did not happen while the service sector has made impressive contribution both internally and externally. However, all sectors, including many regions of India, failed to reap the benefits. As a result, the standard of living and the major economic indicators vary substantially across the states of India. The disparity in manufacturing among the Indian states increased over the years. Though reforms have given a greater scope for state intervention in development initiatives the economic performance of the individual states in the post-reform period received less attention [3]. Desired structural changes have not accompanied the economic growth process. The states that have initiated reforms and strategized their policies successfully differentiated themselves in growth trajectory.

One group of states vigorously invest in different activities to increase industrial and other developmental activities and, hence, the state's competitiveness. These are also the states that have successfully attracted FDI and hence, the growth process. On the other hand, other states have either not realized the importance of firms or are slow in implementing policies towards the growth and development process. The

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Correspondence to: Waqar Ahmed, ICSSR Doctoral Research Fellow, Department of Economics, Tripura University (A Central University), Agartala - 799 022 Tripura, India, Tel: +91 7382044805; E-mail: waqarww325@gmail.com

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concentration of industries, including high technology industries, is also substantially high in the former states.

The following paragraphs highlight a huge disparity among the states of India in India, and the location of firms in India is also highly skewed. Data on firm location among the states of India shows that 80 per cent of active industrial firms are located in only eight states. The growth rate of these states measured in terms of per capita net state domestic product is also above the national average. Maharashtra has 21 per cent of active firms, and Delhi has 19 per cent. On the other hand, the other 15 states have less than 1 per cent of firm concentration. Economic activities are low in these states and, hence, growth. Consequently, invested capital and employment are also high in these states. Interestingly, these states have a large amount of research and development activities.

As such, whether the firm's location decision explains growth disparity in manufacturing in the Indian states is an important issue to be discussed. Therefore, this paper examines the growth disparity in the manufacturing sector within India and identifies the determinant factors working behind the growth disparity in manufacturing among the Indian states. This attempt helps to understand how policymakers may reduce this manufacturing sector gap and help boost India's manufacturing sector. Specifically, this work includes the impact assessment of Infrastructure, innovation, human capital, financial availability and employment level on the manufacturing growth of states.

A number of studies were undertaken to study the convergence of growth rates among the Indian states, including determinants of growth rates and regional disparity among the Indian states. [4] with the help of panel data, examined the relationship between structural change and economic growth of the Indian states. The study concludes that structural change is important in explaining the growth of the Indian economy from 2000 to 2006. [5] examines regional disparity and convergence among the Indian states from 1980-2006. The study concludes that there are wide variations in states' economic performances, and the differences have increased over time. A Similar study on social and economic indicators was done by [6] as well. The paper finds considerable disparities in socio-economic development across the Indian states, and the quality of governance influences the speed of socio-economic progress of the states. The pattern and determinants of economic growth in Indian states were examined with the help of literature by [7], and the growth of different states was characterized by instability and volatility, and disparities among the states measured by the coefficient of variation increased over time. A comparison of regional growth and disparity in India between pre and post-reform periods was also examined by [8]. The study finds that the GDP growth rate increased marginally in the post-reform decade, but regional disparity widened. There is an inverse relationship between population growth and the state's domestic product growth. [9] also examined the convergence of growth rates among the major states of India and found that states are not converging to identical levels of per capita income in the steady state. There is a dispersion of per capita incomes across the states over time, mainly because of disparities in the levels of private and public investment and an insignificant equalizing impact of center-state government transfers. [10] also examined disparity among the Indian states and concluded that the difference in performance across states is enormous and state-specific socio-economic, including institutional factors, are more important in explaining this disparity. A different study was made by [11], who examined the competition for investment among the states of India. Research work on the disparity of income among the states of India [4], [7-10] shows that growth disparity increased over the years, and many factors are responsible for this growth disparity among the states of India.

MATERIALS AND METHODS

Selected variables and data sources

The required data has been drawn from various secondary data sources. The Net State Domestic Product (NSDP) is standard and widely used for economic growth. State-wise data for NSDP at Current price is collected from a set of Handbook of Statistics on Indian States, RBI. A number of firms located and industrial Labour force have been taken as proxies for the industrialization growth among states. Data for state hand book of India, RBI. No of filled Applications (patents + non-resident) is a standard proxy for innovations or new technology used in previous literature, and this data has been collected from R&D statistics, Department of S&T, Govt. of India. The gross enrollment ratio of higher education is also a well-known proxy of human capital formation. This data has been extracted from the various reports of Statistics of Higher and Technical Education published by MHRD, Government of India. Credit deposit ratio of scheduled commercial banks: Physical Infrastructure can include various variables, i.e., density of roads, density of highways and density of railway routes, and data of these variables has been taken from Handbook of Statistics on Indian states, RBI. Further, Credit availability (State-Wise Credit to Industry by Scheduled Commercial Banks) has been considered a proxy of financial Infrastructure and extracted this data from the Handbook of Statistics on Indian States, RBI.

Modeling criterion

This study analyses the role of industrialization (location of firms and industrial workforce), patent application filled, gross enrollment ratio in higher education, financial credit and infrastructure development in explaining the disparities of economic growth among the states of India. This study includes ten major states based on their contribution to the manufacturing share of GSDP. This paper is covering the period from 2004-05 to 2016-17. Therefore, a panel regression model (fixed effect approach and another random effect approach) has been used for the analysis of this panel data set. After applying both approaches, Hausman's specification test and Breusch and Pagan's Lagrangian Multiplier model specification test have been applied for the selection of appropriate models for our dataset. To check the statistical significance relationship among different variables, the Panel regression method has been applied.

The following logarithmic panel regression (Fixed Effect) equation has been estimated in the current work:

$$\text{LN\_NSDP}_{it} = \beta_0 + \beta_1 \text{LN\_No. FIRMS}_{it} + \beta_2 \text{LN\_LABOUR}_{it} + \beta_3 \text{LNROADS}_{it} + \beta_4 \text{LNPATENTS}_{it} + \beta_5 \text{LNCD}_{it} + \beta_6 \text{LNGER}_{it} + \beta_3 \text{LNRAILWAY}_{it} + \beta_3 \text{LN\_HIGHWAY}_{it} \mu_{it} \ldots\ldots\ldots\ldots \text{eq. (1)}$$

In equation (1), where y_{it} is the dependent variable for each i=entity and t=time, X_{it} represents one independent variable, where $\beta_0, , \beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6, \beta_7$ and β_8 are the regression estimators and u_{it} is error term of state i at time t.

The following logarithmic panel regression (Random Effect) equation has been estimated in the current work:

$$\text{LN\_NSDP}_{it} = \beta_0 + \beta_1 \text{LN\_No. FIRMS}_{it} + \beta_2 \text{LN\_LABOUR}_{it} + \beta_3 \text{LNROADS}_{it} + \beta_4 \text{LNPATENTS}_{it} + \beta_5 \text{LNCD}_{it} + \beta_6 \text{LNGER}_{it} + \beta_7 \text{LNRAILWAY}_{it} + \beta_8 \text{LN\_HIGHWAY}_{it} + \mu_{it} + e_{it} \ldots\ldots\ldots \text{eq. (2)}$$

In equation (2), where y_{it} is the dependent variable for each i=entity and t=time, X_{it} represents one independent variable, where $\beta_0, , \beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6, \beta_7$ and β_8 are the regression estimators and u_{it} is the error term of state i at time t and e_{it} the within state's error.

RESULTS AND DISCUSSION

This decade, a globally competitive industrial sector can be pivotal in India's economic growth and job creation. Due to factors like power growth, long-term employment prospects, and skill routes for millions of people, India has a significant potential to engage in international markets. Several factors contribute to their potential. First, these value chains are well positioned to benefit from India's advantages in raw materials, industrial expertise, and entrepreneurship. Second, they can take advantage of four market opportunities: expanding exports, localizing imports, internal demand, and contract manufacturing. In this study, industrialization is the most important factor in analyzing the disparities of states because of the different levels of industrialization growth among the states of India. To understand the industrial concentration, the location of firms and the number of persons engaged in India's industrial sector are analyzed. (Fig 1) depicts the trend and patterns of the number of firms or industries in major selected states of India over the period from 2004 to 2016. The location of the firm's concentration depicts that almost more than half per cent of firms is located in only four states of India; these states are Tamil Nadu, Maharashtra, Andhra Pradesh and Gujarat, and among them, Tamil Nadu stands at first position. In this study, the remaining states U.P., Punjab, and Karnataka, have a medium industrial concentration range. Further, west Bengal and Rajasthan show almost the same industrial location concentration. Thereby, Haryana has the lowest industrial concentration among these selected states. Therefore, this analysis highlights that there is a huge disparity among the states of India, and the location of firms in India is also highly skewed. In fact, there is a huge disparity among the major states of India in terms of the location of firms, and this gap has increased among the states of India. Further, (Fig 2) depicts the trends and patterns of the number of persons working in the industrial sector in these states.

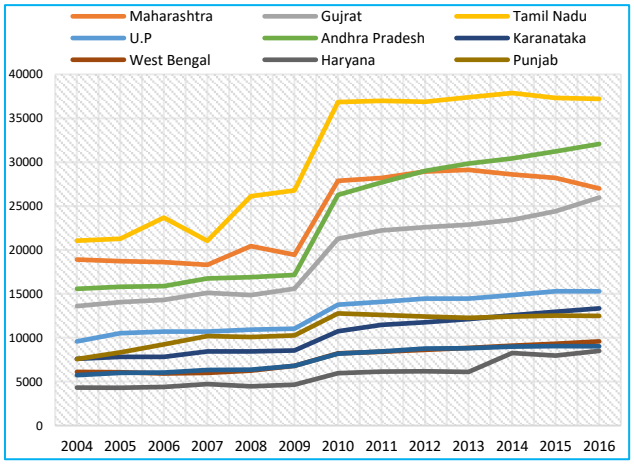

Table 1 Trends of number of firms located in selected states of India

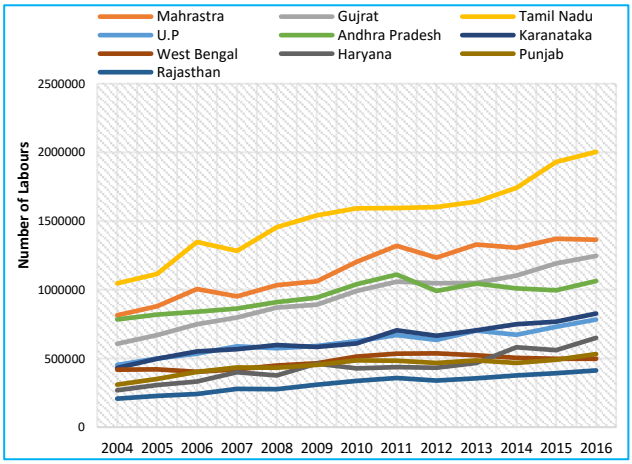

Fig 2 Trend and pattern of number of labours in manufacturing sector

(Fig 2) shows numbers of the labour force in the manufacturing sector of major selected states of India. This trend also shows that the states like Tamil Nadu, Maharashtra, Andhra Pradesh, and Gujrat and among these, Tamil Nadu has the highest labour share in the industrial sector of these states Andhra Pradesh is famously known as labour-rigid stated according to Besley Burges measure. But after 2011, it showed a sharp decline because of low wage rate and worker strikes, and in the remaining six states, U.P and Karnataka contributed almost the same percentage of labour share. And Rajasthan is showing the lowest percentage of labour share among all these selected states of India. Therefore, this analysis also shows a huge disparity among the states in terms of labor share.

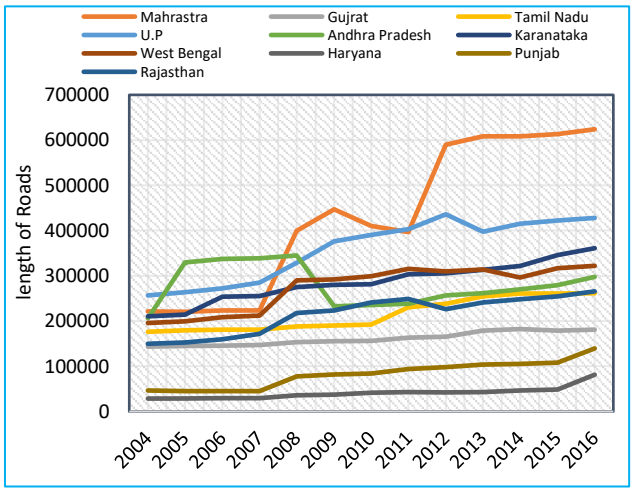

Fig 3 Trends and pattern of length of roads in selected states of India

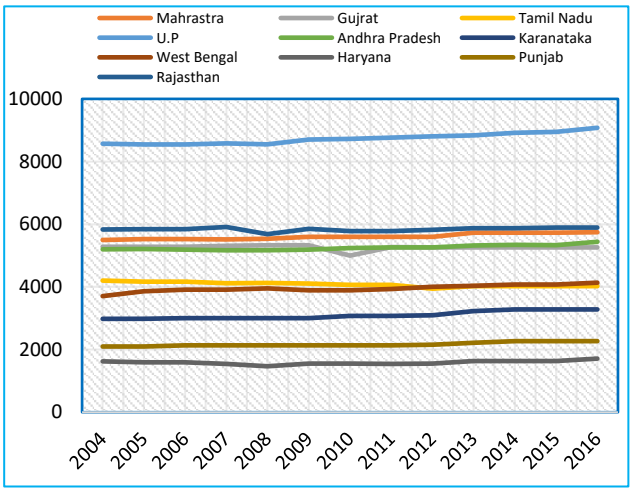

Fig 4 Trends and pattern of state-wise railway routes (Km/s) in India

(Fig 3) predicts the length of the road in terms of km in selected states of India. Among the states, Maharashtra has the first position in terms of length of road, followed by U.P and West Bengal. Haryana and Punjab remain the lowest among the states in terms of road length. There is constant variation among the states in terms of length of road except Maharashtra, U.P and Andhra Pradesh during the period.

(Fig 4) predicts the state-wise railway routes in terms of K.M. Among the selected states, Uttar Pradesh has the first position in terms of railway routes in km, followed by Karnataka and Maharashtra. And states like Andhra Pradesh and Gujrat showed the same trend in terms of railway routes (Km/s). Furthermore, state-wise railway routes of Punjab and Haryana remained lowest in the selected states from 2004 to 2016.

(Fig 5) depicts the trend and pattern of state-wise national highways among the selected states. Still, there is a variation that can be seen in terms of state-wise national highways. States like Uttar Pradesh, Karnataka, Andhra Pradesh, and Tamil Nadu have large number of national highways; Punjab and Haryana have the lowest position in state-wise national highways. So, it can be predicted from the figure that there is a disparity among the states in terms of state-wise highways.

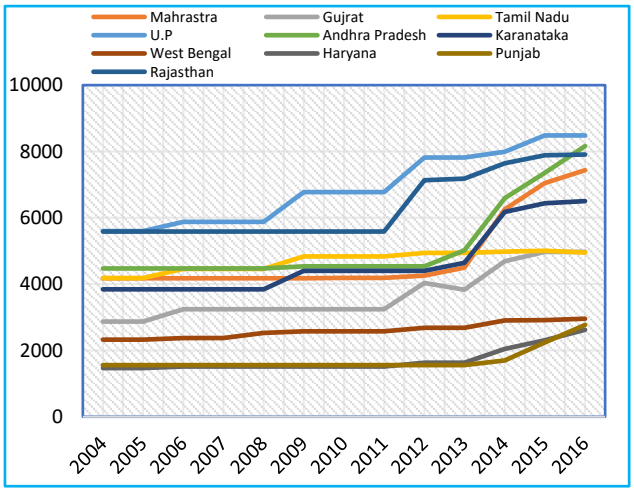

Fig 5 Trends and pattern of state wise national highways in India

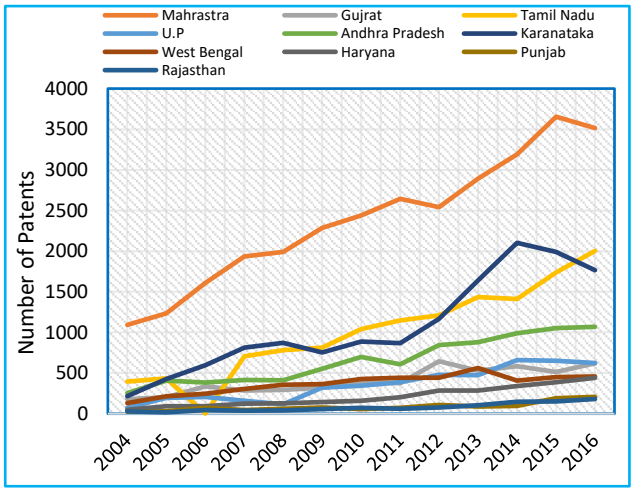

Fig 6 Trends of number of applications filled for patents in selected states of India

(Fig 6) depicts the applications filled for patents in selected states, and it shows that Maharashtra is the leading state in the number of applications filed for patients. Uttar Pradesh stood at the bottom position in terms of applications filed for patients, and there is a huge gap in Maharashtra and Karnataka in the number of applications filed for patients. In the remaining states, there is not much variation regarding patent applications.

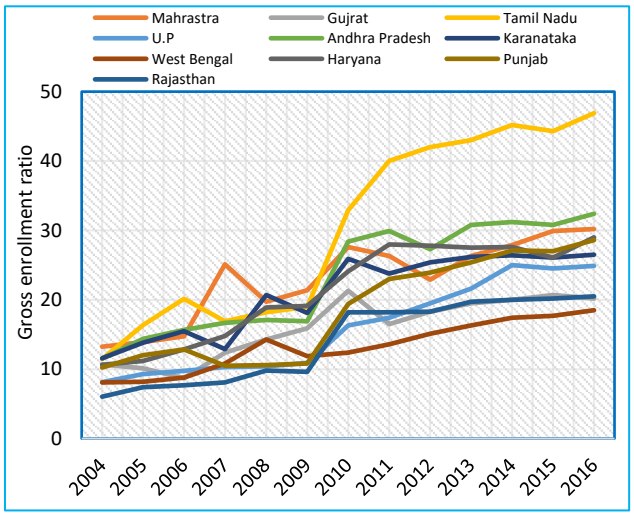

Fig 7 Trends and pattern of gross enrollment ratio in selected Indian States

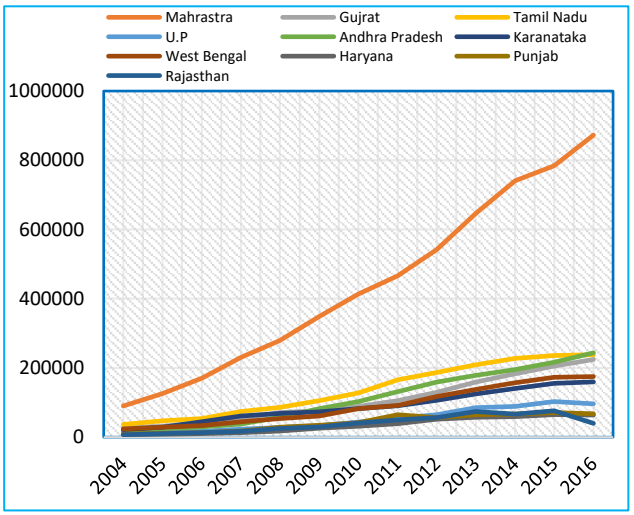

Fig 8 State-wise credit to industry by scheduled commercial banks (Cr.)

(Fig 7) predicts the gross enrolment ratio in higher education from the age group of 18 to 23. This figure shows that Tamil Nadu is a leading state with higher gross enrollments in higher education. Uttar Pradesh and West Bengal stood at the bottom in term of their share in the gross enrolment ratio in higher education.

Data in (Fig 8) depicts selected states' financial systems in terms of credit- to industry by scheduled commercial banks. From this figure, it can be predicted that Tamil Nadu is in the top position and Uttar Pradesh in the bottom position. Over the period from 2004 to 2016, the gap is not much among the states. Despite the disparities in credit allocation between these two extremes, it is noteworthy that the gap among the states did not undergo substantial fluctuations during the examined period. This suggests a degree of stability in these states' relative financial health and performance, with credit distribution patterns remaining largely consistent over time.

Table 1 Summary of descriptive statistics

Variable	Obs.	Mean	Std.	Min	Max
NSDP	130	5.11E+07	3.61E+07	8610813	1.95E+08
No of fims	130	15261.99	9042.542	4304	37878
Industrial labour force	130	750665.8	391756.2	207625	2003759
Density of roads	130	1341.322	712.553	423.3825	3568.708
Patent applications	130	665.0615	764.0798	2	3654
GER in higher education	130	19.72238	8.608643	6.04	46.9
Credit to industry	130	114396.9	147038.4	7000	872600
Density of highways	130	26.29168	9.183393	13.57109	59.30516
Density of railway	130	28.83066	10.36804	15.53775	46.5905

Source: Author's Computation Using STATA

Data in (Table 1) depicts the descriptive summary of selected variables in this study. There is high variation among states in terms of these variables. There is a huge difference between the minimum and maximum values of these variables in the states of India. The high standard deviation values predicted the variation among these states for selected variables, i.e., Net State Domestic Product, Number of indusial firms located in these states, number of workers working in the industrial sector, the density of roads, density of highways, density of railway routes, number of applications filed by these states, Gross Enrollment Ratio in higher education and credit deposit ratio in scheduled banks of these states.

Table 2 Results of panel regression

Variables	Pooled regression	Fixed effect panel regression	Random effect panel regression
Number of firms	0.38321***	0.401818***	0.359779***
	(0.004)	(0.000)	(0.000)
Patent application filled (resident + non-resident)	0.098008**	0.032183**	0.031189*
	(0.014)	(0.037)	(0.052)
Industrial labour force	-0.47314***	0.583053***	0.439924***
	(0.004)	(0.000)	(0.000)
Gross enrollment ratio in higher education	0.015775	0.231894***	0.216655***
	(0.891)	(0.000)	(0.000)
Density of railway routes	-0.11578	0.822358*	0.007184
	(0.319)	(0.077)	(0.979)
Credit to industries	0.540228***	0.276602***	0.322705***
	(0.000)	(0.000)	(0.000)
Density of highways	0.311175**	0.456167***	0.523817***
	(0.029)	(0.000)	(0.000)
Density of road length	-0.01443	0.046726	0.067134**
	(0.859)	(0.376)	(0.021)
_cons	13.08821***	-2.53972	1.636895
	(0.000)	(0.192)	(0.281)
R-Square (over-all)	0.858	0.5388	0.7188
F-test	91.42	597.98	4284.07
Prob.>F	0.0000	0.0000	0.0000
Number of observations	130	130	130
No. of groups	10	10	10

Source: Author's Computation Using STATA 12

Dependent Variable: NSDP

Data in (Table 2) signifies the results of economic growth disparities in Indian states with three different analyses of panel regression: pooled regression, fixed effect panel regression and random effect regression. Net State Domestic Product (NSDP) is a dependent variable in this analysis. In contrast, the number of firms, labourers, length of roads, patents, gross enrollment ratio in higher education, and credit deposit ratio have been used as independent variables. The R-Square value of the overall model is 0.858, 0.5388 and 0.7188, which defines the 85.8%, 53.88% and 71.88% variation in economic growth among Indian states for pooled, fixed and random effect models, respectively. Further, pooled regression, fixed effect, and random effect models' F-test values are 91.42, 597.98 and 4284.07, with a probability value of 0.000 significant at 1%. This depicted that models are all over model is highly significant. In this study, results predicted that industrial location concentration (number of firms located) significantly affects the economic growth of states with 38.32%, 40.18% and 35.97% in pooled, fixed effect and random effect models, respectively. These results are consistent with the previous literature; beginning with the Industrial Revolution, technical changes took place mainly in the manufacturing sector, and expansion of this sector is a driving force for high economic growth [12] [13] [14] [15]. Further, the industrial labour force affects the economic growth among states of India with -47.31%, 58.30% and 43.99% at 1% significance level in three different panel analyses: pooled, fixed effect and random effect models, respectively. According to the pooled analysis results, a 9.8% impact on states' economic growth was predicted by the patent growth among these states. The patent application has 3.2% and 3.1% significance on the growth of Indian states with fixed and random effect models, respectively. New technological development increases the productivity of labour and also improves the efficiency of resource utilization.

Further, pooled regression results depicted that the gross enrollment ratio in higher education has a positive but insignificant effect on the economic growth of Indian states. The fixed and random effect results predicted that 23.18% and 21.60% have a significantly positive impact on the economic growth of Indian states. This may be because workers with higher education can better master new technology and have more innovative abilities, which is extremely meaningful in the present world. Higher education has more skill and a significantly positive impact on economic growth; these results are consistent with [16].

Transport infrastructure positively impacts the economic growth and development of Indian states. The highway density has a positive and significant impact on economic growth with 31.11%, 45.61% and 52.38% with p values 0.029, 0.000 and 0.000 for pooled, fixed effect and random effect, respectively. The density of roads positively impacts economic growth with 4.67% and 6.21%, with p values 0.376 and 0.021 for fixed effect and random effect, respectively, and statistically significant at 5% for random effect. Railway routes have a positive impact but are significant at 5 % in the fixed effect model, with an 82.23% impact on economic growth. The coefficient of railway routes has a positive impact but is insignificant in the random effect model. Apart from improving accessibility, infrastructure development brings along trade and investment opportunities to the previously unconnected regions. It also provides access to goods, services and employment opportunities in these regions through the multiplier effect. In addition, Infrastructure can also reduce the cost of delivered goods, facilitate the physical mobility of people and products, remove productivity constraints, and increase competitiveness. In the case of the Indian economy, we found that the density of highways is the most important component of transport infrastructure to explain economic growth disparities among the states. The coefficient of Credit to Industry by Scheduled Commercial Banks affects the economic growth among states of India with 54.02%, 27.66% and 32.27% at 1% significance level in three different panel analyses: pooled, fixed effect and random effect models, respectively.

Model specification test

We applied two model specification tests in this study. The first is Hausman's model specification test, and the other is Breusch and Pagan's Lagrangian Multiplier model specification test. Hausman test can be applied to select the appropriate or fit model from fixed and random effect tests of Panel regression [17]. In Hausman's test, the Null hypothesis is *"Random effect model is appropriate"*, and the Alternative hypothesis is *"Fixed Effect model is appropriate"*. If the p-value of Chi2 is less than 5% significant, then we can reject the null hypothesis, which means the fixed effect model is appropriate for this dataset or vice-versa. The L.M. test helps select appropriate models between a random effects panel regression model and a simple pooled regression model. The null hypothesis of the L.M. test is that *"variance across entities is zero" or no significant difference across units (i.e., no panel effect).* If p- the value of chibar2 is greater than 0.05, we failed to reject the null and conclude that random effects are not appropriate. There is no evidence of significant differences across countries. Therefore, you can run a simple OLS regression. The results of Hausman's model specification test and Breusch and Pagan's Lagrangian Multiplier model specification test are depicted in (Table 3).

Table 3 Model Specification tests

	Hausman's Test	Breusch and Pangan's Lagrangian Multiplier Test
Chibar2	17.8	371.98
Prob>chibar2	0.0528	0.000

Source: Author's Computation Using STATA

In this study, the Chibar2 value is 17.8, and the p-value of 0.0528 is greater than 0.05. Therefore, Hausman's test recommends the random effect model to examine the given factors to explain the growth disparities among selected states of India during the study period. This means that differences across entities are responsible for explaining the states' disparities in growth. Further, the L.M. test results found that the p-value of chibar2 (0.0000) is less than 0.05 significance level. Thus, we can reject the null hypothesis and conclude that random effect is an appropriate model. Therefore, both specification tests recommended the random effect panel model to investigate the impact of industrialization (number of firms and industrial labour force), research activities (Patent application filled), skill of people (GER in higher education), physical Infrastructure (density of roads, highways and railway routes), financial infrastructure growth on the economic growth (NDSP) of Indian States.

The study's overall results found that economic growth disparities exist among the major states of India, and industrialization, physical and financial infrastructure growth and skill of people determine this discrimination among these states.

CONCLUSION

The principal aim of this study is to investigate the role of industrialization, patent application filled, gross enrollment ratio in higher education, financial credit and infrastructure development in explaining the disparities of economic growth among the states of India over the period 2004-2016. This study's empirical random-panel regression results indicated that industrial concentration and industrial labour force participation positively influence economic growth. The positive relation between industrialization and economic growth reveals that a 1% increase in the number of firms' industrial labour force will increase the net state domestic product by 0.359 and 0.439, respectively. The number of patent applications positively influences the net states' domestic products of Indian states. It displays that a 1 % increase in credit to the industrial sector will improve the economic growth of these states with 0.0311. Innovation is one of the major factors affecting economic growth through the development and modernization of production methods. Technological progress allows for the more efficient production of more and better goods and services, which prosperity depends on. Results also indicate that financial development (measured by domestic credit to the industrial sector) positively influences the economic growth of Indian states and reveals that a 1% increase in credit to the industrial sector by commercial banks will generate an increase in economic growth with 0.322 among these selected states of India. These results support the previous literature that efficient financial systems- banks, equity markets, and bond markets- which channel capital to its most productive uses- benefit economic growth [19] [20]. Education is found to be positively associated with economic growth and displays that a 1% increase in the gross enrollment ratio in

higher education will generate an increase of 0.2166 in the economic growth of states. In addition, physical Infrastructure also positively influenced states' economic growth and revealed that a 1 % increase in the density of roads, highways and railway routes would generate an increase in net state domestic product of states with 0.067, 0.5238 and 0.0071, respectively. The study's findings define that physical Infrastructure creates positive economies of scale for developing different economic activities in any economy. These results also indicate that highways will capture most of the transport of raw materials and produced goods within Indian States. These findings clearly explain that industrialization, financial development, new technology, physical infrastructure and higher education are important factors in stimulating and enhancing the economic growth of Indian States and also play an important role in explaining the growth disparities among the Indian States.

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