International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

Impact of Educational Infrastructure on Economic Growth - An Empirical Study of India

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Abstract

A complex web of interdependencies between economic growth and the education is always a topic of debates. Education is key to human development which indirectly key to economic growth and theories of economic growth and development show a positive relation between economic growth and education.

This study aims to present thegrowth of educational infrastructure and its impact on GDP. GDP is the dependent variable of the study and mean year of schooling, number of schools, and enrollment in school education are independent variable of the study. These studies used time series date from 1991 to 2021 and test used are unit root test – ADF and PP, and ARDL (Autoregressive distributive lag model) at lag 4. The objectives of study are to find the effect of increase in number of school and its impact on GDP, and increase in school enrollment and its impact on GDP. In results we find positive relation between enrollment in school education and GDP, and negative impact of number of school on GDP.

Keywords: Human Development; Economic Growth; Educational Infrastructure; Human Development; Research and Development; ARDL Model; Time Series Analysis

Introduction

Education

Education is a fundamental pillar of societal development, equipping individuals with the knowledge, skills, and critical thinking necessary to navigate a complex world. Understanding factors that influence educational participation is crucial for policymakers and educators to optimize educational opportunities and outcomes. This study aims to find growth in GDP at the current price due to the growth of educational infrastructure in India. The growth of educational infrastructure is an investment in the development of human capital, which shows growth in the economy. According to different organizations, like the World Bank, UN, etc., they are in favor of the development of educational infrastructure for the growth of the economy. India took different steps through its education policies after independence. India's independence marked the commencement of a new era in education policy. The country has encountered numerous problems and challenges due to the immense diversity of Indian society. In order to tackle these obstacles and propose comprehensive solutions for educational issues, the government has formed education commissions with the aim of enhancing the education system in India.

History of Education policy in India (Post Independence)

The first prime minister of Independent India, Mr. Pandit Jawaharlal Nehru, aims to establish higher education institutions to uplift the Indian economy. The first policy - "University Education Commission (1948)", under the chairmanship of Dr. S. Radhakrishnan. The objective of this commission was to establish institutions that would impart knowledge and wisdom to facilitate the holistic development of individuals. University education is regarded as a crucial milestone for attaining a more advanced degree of knowledge. The primary objective of establishing a university in a certain region was to ensure equitable access to higher education for all segments of society, regardless of geographical location, social class, gender, or ethnicity. The "Secondary Education Commission (1952)," under the chairmanship of Dr. A. Lakshmanaswami Mudaliar, recommended establishing multipurpose high schools and technical schools. Some other policies are the "Indian Education Commission (1964)," also known as the Khothari Commission, and the "National Policy of Education (1968)," which is formulated on the basis of the Khoth Commission. It is considered a millstone in improving the gross enrollment ratio because it suggests the provision of compulsory education for 6 to 14 year age group education in the Indian Constitution, but it is implemented under the "Right to Eduction Act (2009)," and this act came into existence in April 2010. The "National Policy on Education (1986)" has the major objective of providing education to all (scheduled tribes, scheduled castes, other backward classes, and especially women). This policy also introduced open universities for distance learning by establishing the Indira Gandhi National Open University (IGNOU) for people from poor and rural backgrounds. "Sarva Shiksha Abhiyan(SSA)" is a central government program that was launched for the universalization of elementary education and has been in operation since 2000-2001.

Educational institutions are second homes for their students.

Educational institutions are considered the second home for students, especially school education institutions, which have a great impact on an individual's life. The environment and infrastructure of educational institutions play a main role in the development of human capital. It improves the quality of education and the productivity of the students. Students spend half of their daily routine in educational institutions. As people become more aware of the quality of education and the environment of educational institutions, they prefer to send their words to institutions with better facilities. The proper infrastructure also motivates teachers.

GDP Growth in India in three decade –

GDP Growth in India is been remarkable after 1991. The LPG policy 1991 totally transformed Indian Economy and its open India for great exposer which boosts GDP of India. I., A., Gurin. (2022), Pooja, Monga., S., C., Batra. (2019), and Sonawane Ganesh Dattatray (2022) supports the LPG reforms and its positive impact on GDP in their studies. GDP growth in 1992 by 5.48% from 1991 with GDP - $288.21B and GDP growth in 1994 is 6.6% with GDP $327.28B. GDP growth in 1997 from 1996 is 4.15%. In 2000 Indian GDP is of $468.39B and even in the global financial crisis of 2008 – 2009, India managed average 7% GDP growth and GDP of $1198.90B highest of all times and become the savour of globe economy from financial crisis when no developed GDP able to do so. GDP growth of India fall a dip during 2016-2017 and 2017-2018 due to demonetization and GST. In 2020-2021 global economic

growth and Indian GDP growth straggling due to Covid-19 pandemic. Over all with all the up and downs Indian GDP in 2021 was $3150.31B.

Relationship between GDP growth and growth in educational infrastructure

Vijay, Jariwala (2017) show the relationship of investment in education impact positively GDP growth in India. This research tries to find the impact of educational infrastructure on GDP (at the current price). Accordingly We studied the relationship between educational variables like- the number of schools, enrolment in schools, the mean year of schooling, and there impact on GDP (at the current price). This study focuses on two key educational stages: school and higher education. School enrolment serves as the foundation for further educational pursuits, while higher education enrolment equips individuals with specialized knowledge and skills for specific careers or advanced academic study. We analyze the time series data from 1991 to 2021 for educational and GDP. To establish the relationship, we used the ARDL technique. By analyzing these variables, this research aims to shed light on the educational landscape and identify potential areas for improvement. The findings can inform policy decisions regarding resource allocation, infrastructure development, and teacher training programs, ultimately contributing to a more robust and equitable educational system.

LITERATURE REVIEW

Kotásková, S. K., Procházka, P., Smutka, L., & Hönig, V. and others (2018) investigate the correlation between education and economic growth in India. They employ time series data to examine data from India spanning the years 1950 to 2010. They discover a robust correlation between schooling and economic growth. More precisely, their findings indicate that a one-year increase in the average duration of education is linked to a 0.37% rise in GDP growth. The authors additionally discover that the correlation between education and economic growth is more robust for higher levels of education. For instance, they discover that a one-year increase in the average duration of postsecondary education is linked to a 0.67% rise in GDP growth. They assert that education has a pivotal role in stimulating economic progress in India. They contend that the government should allocate funds towards education in order to foster economic expansion. The authors propose that making investments in education is a crucial strategy for fostering economic growth.

Md. Atif Alam and Prof. Sarita Agrawal (2023), explore the effects of government funding on primary education in the state of Bihar, India. The authors advocate for a transition in emphasis from solely raising enrollment rates to improving the overall caliber of education provided in primary schools. Their research endeavors to shift the discourse from solely focusing on the amount of education to highlighting the caliber of educational results.

Shakirat Adepeju Babatunde (2018), examines the correlation between government expenditure on infrastructure and economic development in Nigeria. The study reveals that allocating resources to specific categories of infrastructure can have a substantial impact on fostering economic growth. Based on his research, positive impacts are Investing in transportation, communication, education, and health infrastructure is associated with economic advancement. The negative impact is Curiously, the study indicates that government expenditure on agriculture and natural resource infrastructure may have a contrary impact. The author advocates for a focused strategy for allocating resources to infrastructure

development, giving priority to areas that have demonstrated a clear and beneficial effect on the economic growth of Nigeria.

Aabid Ahmad Koka and Dr. Sandhya Bohre (2019), explore the correlation between government spending and the progress of education in Jammu and Kashmir. Using a statistical methodology, they evaluate the influence of government expenditure on education on the advancement of education in the area. Their investigation indicates a positive link, albeit a weak one. This implies that although additional funds can play a role in enhancing education, they are unlikely to be the only or most important element.

Hanushek and Wößmann's research, "The Role of Education Quality in Economic Growth," denies the oversimplified notion that economic growth is exclusively dependent on expanding the duration of schooling. Their research emphasizes the critical importance of educational quality as it relates to the cognitive abilities that students actually develop. Their research indicates a robust association between highly developed cognitive ability and favorable economic results. This results in increased personal income, a fairer allocation of wealth within a society, and overall economic expansion for the country. The main point is that investing in enhancing the quality of education and ensuring among students is more important for economic growth than solely prioritizing school attendance figures.

A study conducted by Stephen Machin (2014) validates a substantial and swiftly growing collection of research conducted by economists on the topic of education. This research is based on empirical methodology and fundamental economic principles, and it has direct implications for policymaking. There has been a significant increase in high-quality and rigorous research studies investigating a range of educational difficulties throughout a person's life. The research, which has evident policy importance, have greatly enhanced the field's reputation. In addition, the increase in high-caliber research has contributed, to some extent, to a greater influence of economists in education policy, evaluation, and advisory positions. The continuation of this trend is probable, as the field of economics in education continues to attract a significant number of graduate students and young scholars.

The study done by Ibrahim Abubakarr Bah in 2023, "Education and Economic Growth - A Cross-Country Analysis," examines the influence of education on economic growth in different nations. The data analysis encompasses 89 countries with varying economic levels, including poor, middle, and high-income nations, covering the time period from 2002 to 2020. A positive association has been identified between education levels and economic growth. The impact of education on economic growth is more pronounced in low- and middle-income countries as opposed to high-income countries. The study indicates that allocating resources towards education can be an effective approach for attaining economic expansion, especially for countries in the process of development.

The research conducted by Olukemi I. Lawanson and Dominic Ikoh Umar in 2020 is titled "Education Expenditure-Led Growth: Evidence from Nigeria (1980-2018)". The study examines the influence of government spending on education on the economic growth of Nigeria between the years 1980 and 2018. Time series econometrics tests such as Unit Root, cointegration, Error Correction Model, and Granger Causality were utilized. All levels of education expenditure have a positive contribution to economic growth, with tertiary education having a more substantial benefit.

The study conducted by Ibrahim Mohammed Gunu and Ibrahim Yakubu in 2022 explores the correlation between government expenditure on education, school enrollment rates, and economic growth in Ghana over the period of 1970 to 2017. The study utilizes the autoregressive distributed lag (ARDL) method, relying on the findings of the Phillips-Perron unit root test. This study indicates that the extent of government expenditure on education did not have a substantial effect on the economic growth of Ghana, both in the short and long run. The study show a favorable relationship observed between school enrollment rates and economic growth. The rise in student enrollment at both elementary and secondary schools was correlated with economic advancement. The research discovered a detrimental correlation between tertiary education enrollment and long-term economic growth in the field of Tertiary Education. It emphasizes the need of ensuring that monies designated for education are utilized efficiently to enhance the quality of education.

The research conducted by Elnaz Hajebi and Mahtab Hajebi (2023) investigates the impact of government expenditure on education on enrollment rates in OECD (Organisation for Economic Co-operation and Development) countries, across different educational levels. The analysis indicates a direct relationship between government spending on education and rates of enrollment. Consequently, when governments allocate more funds towards education, there is a direct correlation with increased enrollment rates at the basic, secondary, and tertiary levels. Hajebi and Hajebi's data indicates that this beneficial impact applies to all educational levels across OECD countries.

"Higher Education and Economic Growth in European Regions (2000-2017)" is a study conducted by Agasisti and Bertoletti (2022) that examines the relationship between higher education systems (HES) in different parts of Europe and their impact on economic growth. The study covers a span of 18 years, from 2000 to 2017, and includes data from 284 European regions. The analysis relies on a distinctive dataset that integrates information from diverse sources such as Eurostat, OECD, and In Cites. This dataset encompasses variables such as the concentration of universities, the size of the higher education system, research performance, and other pertinent criteria. The research indicates that universities have a beneficial impact on the economic prosperity of regions. Regions that have a greater concentration of universities generally exhibit more robust economic performance. The study demonstrates that the caliber of research and a concentration on Science, Technology, Engineering, and Mathematics (STEM) disciplines are pivotal elements propelling this favorable influence. Universities that possess robust research programs and specialize in STEM subjects make a more substantial contribution to regional economic development.

The study named "Does Education Matter for Economic Growth" was conducted by Michael S. Delgado, Daniel J. Henderson, and Christopher F. Parmeter in 2014. The research examines the use of mean years of schooling as a substitute for human capital in empirical growth regressions. This statement emphasizes that the importance of education in these statistical analyses can differ depending on the individual group of data or the way the model is defined.

The study utilises a non-parametric local-linear regression estimator and a variable relevance test to thoroughly evaluate the statistical significance of the mean years of schooling. This methodology enables a methodical analysis of the correlation between education and economic growth, providing insights that go beyond conventional parametric techniques. The research used a wild bootstrap method

to estimate standard errors, which is recognized for its resilience to heteroskedasticity. Utilizing this strategy is essential for acquiring dependable statistical conclusions when there is variation in the data, hence improving the credibility of the study's findings.

The paper “What is the real effect of schooling on economic growth?” by Rudolf Kublik in 2015. The paper is about the effect of schooling on economic growth. This paper uses GMM model to estimate the panel data of 86 countries from 1960-2005. It finds positive impact of schooling on economic growth. This paper presents two significant results. First, positive contribution of additional year of schooling to per capita output growth; and second, high percentage share of population with no formal education results in a slowdown in economic growth.

The paper “Dynamic effect of Chinese GDP and number of higher education based on cointegration” by Fei-xue Huang and Chengli in 2010. This study examines the impact of higher education scale on GDP. This paper used the annual data of GDP and number of students enrolled in regular institutions as variables from 1952–2004. The method used are unit root test, cointegration test, vector error correlation model (VECM), variance decomposition, etc.

Study “the relationship between higher education and economic growth in Pakistan” by Arshad Ali, Roshan Abdul Hakim, and Hussin Abdullah in 2016. This study analyzes the relationship between higher education and economic growth in Pakistan by using Granger causality and Johansen cointegration. The study was conducted from 1982 to 2014. The finding of this study is that there is no casual relationship between higher education enrollment and gross domestic product (GDP).

The study “Effect of Economic Growth in Relation to Unemployment” by Shkumbin Misini and MyrvetBadivuku - Pantina in 2017. The study includes a macroeconomic analysis of economic growth and unemployment and uses nominal GDP and unemployment as its two variables. This paper used a scatter plot graph to represent nominal GDP in relation to unemployment and also analyzed descriptive statistics. Finally, a simple linear regression method is used to analyze the relationship between nominal GDP and unemployment.

Paper “This paper looks at time series data of higher education and teachers working in Nepal's lower secondary and secondary school GDP from 1975 to 2009. It also uses unit root and cointegration test tools to look into the causality in Granger's sense. of higher education and teachers working in the lower secondary and secondary school GDP of Nepal from 1975 to 2009 and investigates the causality in Granger's sense employing unit root and cointegration test tools.

In the study, The Impact of Human Capital on Economic Growth: “Improving Accessibility for Higher Education in Indonesia,” by Wasifah Hanum and TettyLasniroha in 2014. This analysis has been done for nine-year period from 2005 to 2013. The net enrollment rate for colleges and the gross enrollment rate for colleges serve as proxies for the economic growth variable, GDP. The findings of this paper are that first, human capital is represented by education, and education has positive impact on economic growth.

The study titled "Impact of population growth, poverty, and unemployment on economic growth" was conducted by Umar Bala, Aminu Ibrahim, and Nazeef Bala Hadith in the year 2020. The paper examines

the economic growth in Nigeria by employing the Auto Regressive Distributed Lag (ARDL) and unit root test methodologies. The study report concludes that policy makers should prioritise the expansion of the real economic sector in order to boost productivity, alleviate poverty, and achieve rapid economic growth. Additionally, it suggests replacing non-protective imports with domestic products and creating an attractive environment to attract international private investors.

The research paper titled "The Relationship between School Education and Economic Growth in Pakistan: An ARDL Bounds Testing Approach to Cointegration" was authored by Muhammad Afzal, Muhammad Shahid, Khalil Ahmad, Ishrat Begum, and M. Abdul Quddus in 2010. This study aims to examine the relationship between school education and economic growth in Pakistan, specifically focusing on the short-term and long-term effects. The analysis utilises annual time series data from 1970 to 2009, including real GDP, real physical capital inflation, and general school enrollment. The research findings demonstrate a clear correlation between school education and economic growth in Pakistan.

The research paper titled "The Impact of Education on Economic Growth: A Case Study of India" by Sylvie KobzevKotásková, Petr Procházka, Luboš Smutka, Mansoor Maitah, Elena Kuzmenko, Markéta Kopecká, and Vladimír Hönig in 2018 examines the correlation between education and economic growth in India. The study analyses 30 years of economic growth data in India, focusing on primary, secondary, and tertiary education from 1975 to 2016. The econometric tools utilised for estimating the link include the Granger causality method and the cointegration method.

OBJECTIVE OF THE STUDY

To analyze the relationship between school education variables and economic growth.The mean years of schooling, number of schools, and enrollment in school education are used as proxy variables to explain educational infrastructure and GDP per capita is used as proxy for economic growth.

The following hypotheses were formulated:

H1	Mean years of schooling has a significant and positive impact on GDP per capita.
H2	Number of schools has a significant and positive impact on GDP per capita.
H3	Enrollment in school education has a significant and positive impact on GDP per capita.

DATA AND METHODOLOGY

Data Description

The study analyzed time series data from the period 1991 to 2021. The data for the variables were available as follows:

- Gross Domestic Product per capita (Constant 2010 US $) from 1991 to 2021.
- Mean years of schooling (years) from 1991 to 2021.
- Number of schools from 1991 to 2021
- Enrollment in school education from 1991 to 2021.

Statistical summary of variables in the model

VARIABLE	NAME	DEFINITION	UNIT	SOURCE
GDP	GDP per capita growth (at constant USD 2010)	"GDP per capita is the sum of gross value added by all resident producers in the economy plus any product taxes (less subsidies) not included in the valuation of output, divided by mid-year population."	USD	World Development Indicator (WDI)
MYS	Mean Years of Schooling	"Average number of completed years of education of a country's population aged 25 years and older, excluding years spent repeating individual grades."	Years	UNDP
NS	Number of Schools	"Total numbers of schools registered in a given year."	Numbers	UDISE, UDISE+, and Different reports by Ministry of Education, GOI
ESE	Enrolment in School Education	"Sum of total students enrolled in schools at different levels."	Numbers	UDISE, UDISE+, and Different reports by Ministry of Education, GOI

Empirical Methodology

The aim of this study is to establish the relation between GDPper capita and three distinct independent variables, namely MYS, NS, and ESE. The relationship between these variables can be described by a log-linear model as follows:

$$lnGDP_t = \propto_0 + \propto_1 lnMYS_t + \propto_2 lnNS_t + \propto_3 lnESE_t + \in_t$$

Where ln is the natural logarithm, GDP is Gross Domestic Product, MYS is mean years of schooling, NS is number of schools, ESE is enrollment in school education, and $\in_t$is a standard error term. We have employed the ARDL technique provided by Pesaran et al. (2001) by following the research conducted by Nwani and Bassey Orie (2016) and Nwani et al. (2016). The ARDL technique has certain advantages over other standard cointegration approaches such as EG. These co-integration procedures, on the other hand, demand that all variables be integrated in the same sequence. Whether the variables are integrated at I(0), I(1), or mutually co-integrated, the ARDL test method yields successful findings (Pesaran et al., 2001).The utilisation of the ARDL model is favoured for this investigation due to the presence of a small observational scale and multiple orders of integration among the research variables. The equation of an

ARDL model is presented below:

$$\Delta lnGDP_t = \beta_0 + \sum_{i=1}^{\rho} \beta_{1i} \Delta lnGDP_{t-i} + \sum_{i=1}^{\rho} \beta_{2i} \Delta lnMYS_{t-i} + \sum_{i=1}^{\rho} \beta_{3i} \Delta lnNS_{t-i} + \sum_{i=1}^{\rho} \beta_{4i} \Delta lnESE_{t-i} + \beta_5 lnGDP_{t-1} + \beta_6 lnMYS_{t-1} + \beta_7 lnNS_{t-1} + \beta_8 lnESE_{t-1} + \in_t$$

where Δ represents the difference operator.The test includes an F-test of the joint significance of the coefficients of lagged variables to verify that there is a long-run relationship between the variables. The null hypothesis about the absence of a long-term relationship between the variables (H0: β5 = β6 = β7 = β8 = 0) was tested according to Pesaran et al. (2001). The decision of H0 can be rejected or accepted mainly on the following conditions:If the F-test value> upper critical bound (UCB), then reject H0 which justifies the existence of cointegration among research variables. On the other hand if F-test value < lower critical bound (LCB), then accept H0, therefore cointegration is not evident between the variables. However, if the F-test values ≥ LCB and ≤ UCB, the decision is inconclusive. An ECM to estimate short-run relationships can be formulated as follows:

$$\Delta lnGDP_t = \beta_0 + \sum_{i=1}^{\rho} \beta_{1i} \Delta lnGDP_{t-i} + \sum_{i=1}^{\rho} \beta_{2i} \Delta lnMYS_{t-i} + \sum_{i=1}^{\rho} \beta_{3i} \Delta lnNS_{t-i} + \sum_{i=1}^{\rho} \beta_{4i} \Delta lnESE_{t-i} + \alpha_1 ECT_{t-1} + \in_t$$

The coefficient (α1) of the ECMt-1 has a statistically significant negative value, indicating that any persistent deviation between the dependent and independent variables would eventually converge towards a long-term equilibrium relationship.

RESULTS AND DISCUSSION

Trend analysis of the variables

The study variables' trends are illustrated in Figure 1.

Trends of the variables over the study

FIGURE: 1

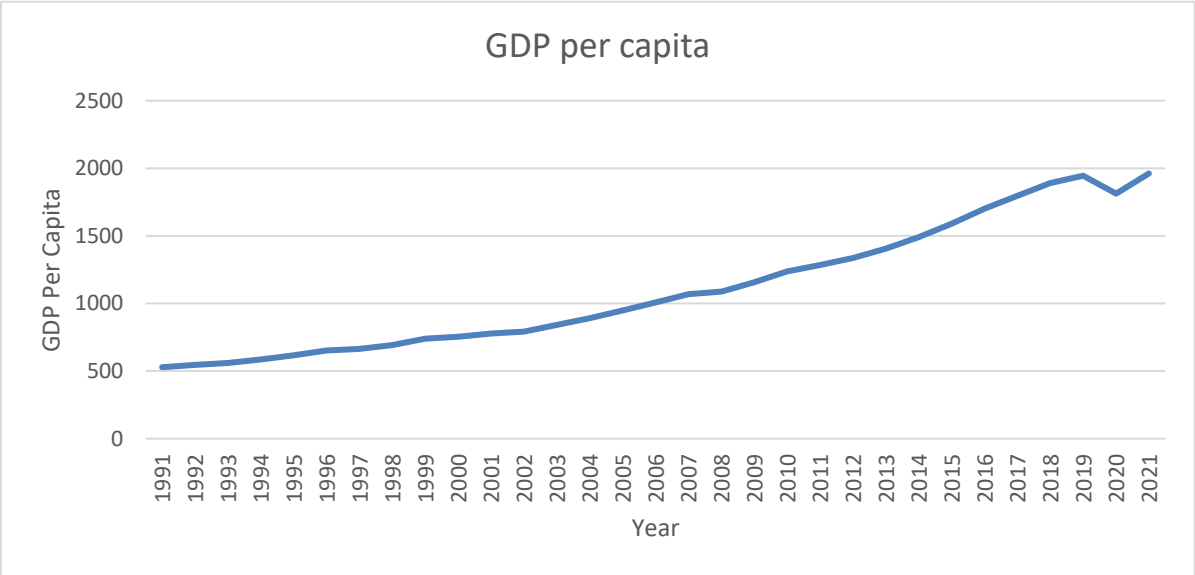


FIGURE: 2

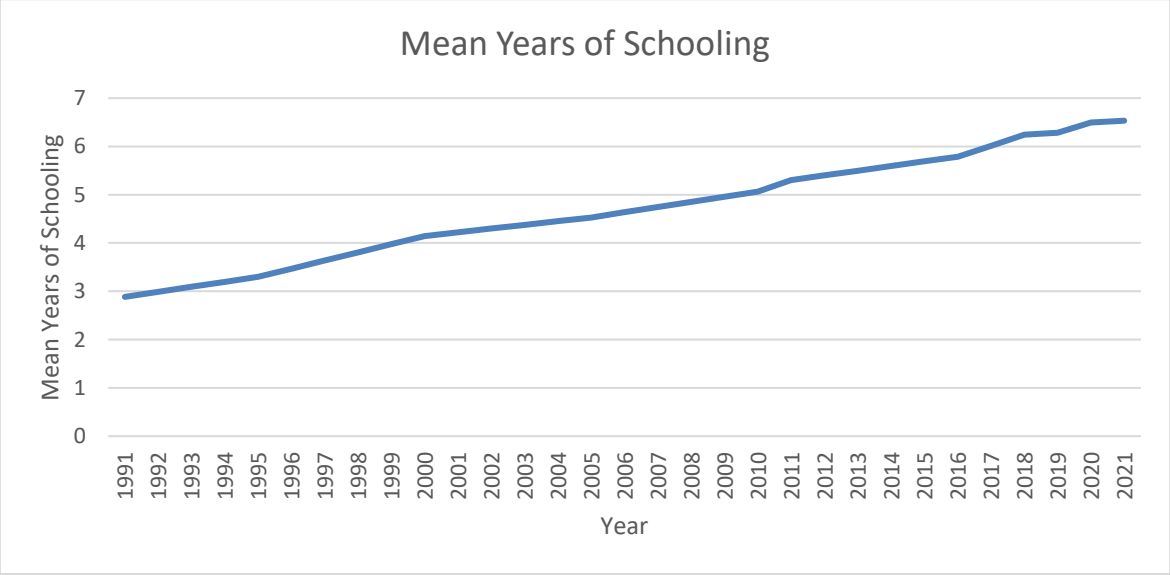


FIGURE: 3

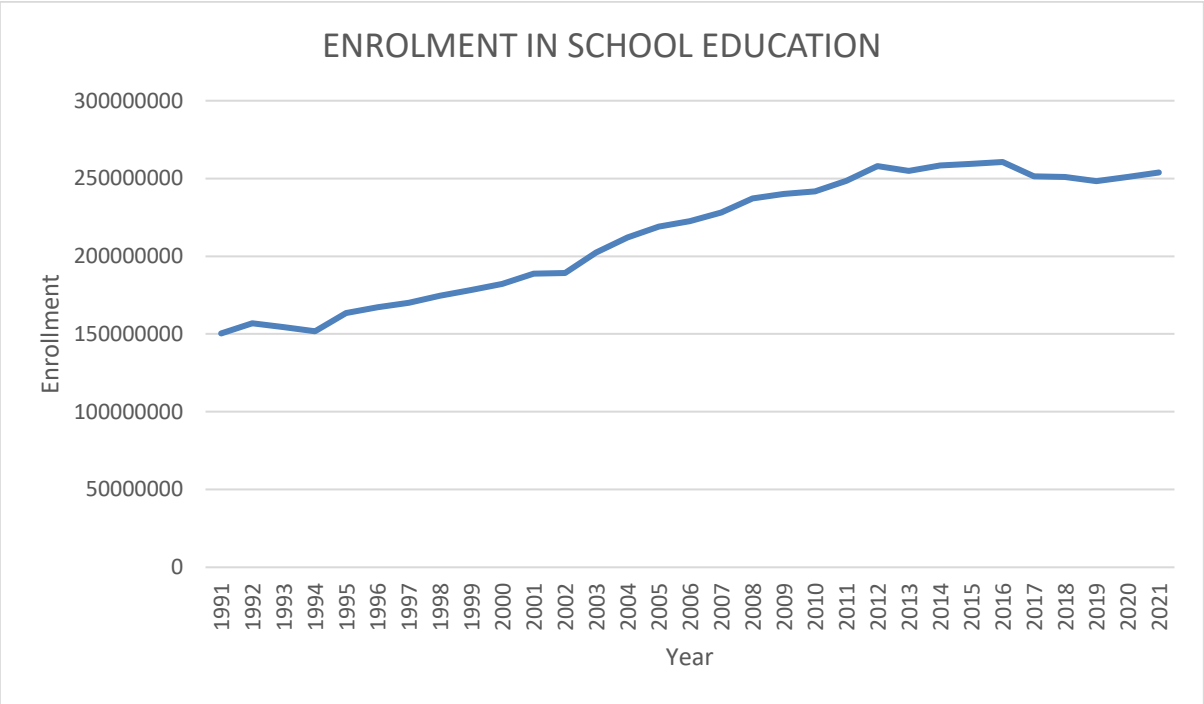
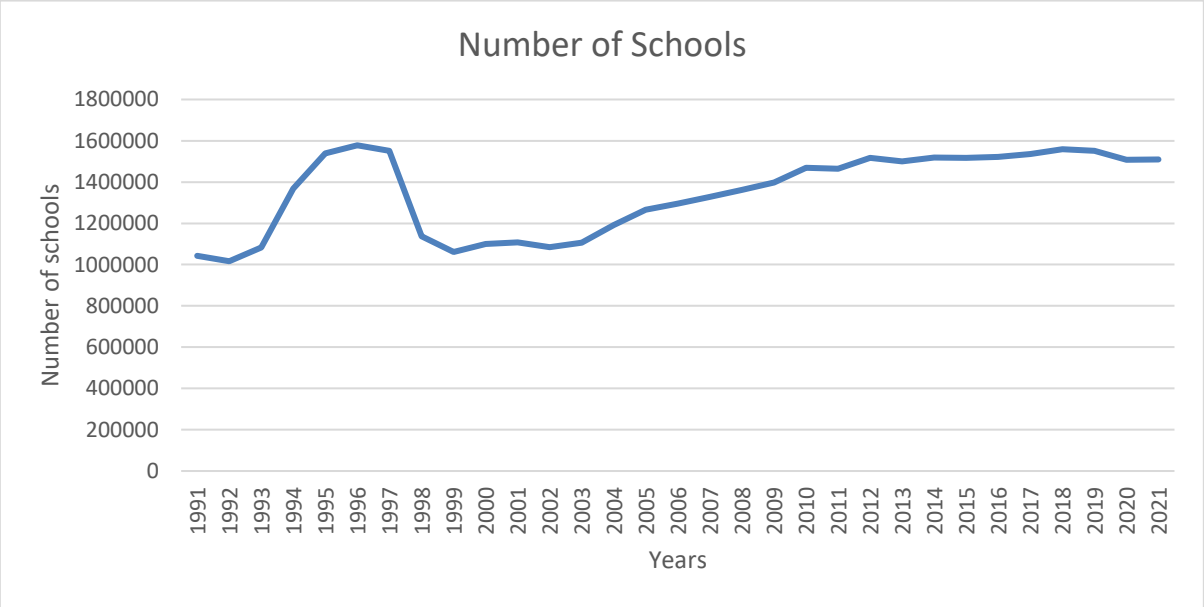


FIGURE: 4



The trends in the study show a positive growth in an avarage with number of years. The dependent variable GDP growth in figure1. has significant increase over the years only trend show GDP growth slow down during 2019-2020 and show a positive increase in GDP growth. In figure 2. The trend analysis of Mean year of schooling show a avarage constant positive increase in mean year of schooling over the years. In figure 3. Show a increase in enrollment in shool education and it also highlight that increase in enrolment is not a constant prosses over the year. Few years are highlights the decrease in school education. Over all enrolment in school education increases in the last three decedes. Trend of

varible number of schools in figure 4. Show a increase and decrease in the number of schools over the years. Number of schools increased till 1996 and shows a sudden fall in the numbers and then show a slow increase in number of years with ups and downs over the years.

Unit root analysis

This study aims to assess the persistent relationship between MYS, NS, ESE, and GDP, prior to employing the ARDL approach. It is essential to determine the order of integration of the variables as a precursor. The validity of the ARDL technique is contingent upon the series exhibiting either integrated of order zero I(0), integrated of order one I(1), or a combination of both I(0)/I(1). The primary assumption behind the ARDL approach is that the time series data should be integrated at either order I(0) or I(1). However, if a study variable is integrated at order I(2), the F-test loses its validity in determining the existence of a long-term relationship. Hence, the unit root test, specifically the ADF test, was employed in this research. The ADF unit test results presented in Table I show that MYS is stationary at level I(0), and all the other variables i.e. GDP, NS, ESE are stationary at first difference I(1).

TABLE 1

Table 3. ADF and PP unit root tests

Variables	**ADF**		**PP**	
	Level	First difference	Level	First difference
lnGDP	-2.622623	-5.231504*	-2.500444	-5.224741*
lnMYS	-3.264586**	-3.963074**	-2.824622	-3.994744**
lnNS	-2.522893	-3.566710*	-2.022814	-3.483857*
lnESE	-1.979961	-4.691138*	-1.957610	-4.764030*

*, and **represents 1%, and 5%level of significance.

Source: Author's calculations

Long Run Bound Test Approach

Given that all the variables in this study are integrated at order one (I(1)), the ARDL approach (developed by Pesaran et al., 2001; Narayan and Narayan, 2005) is employed. Table 2 presents the outcomes of the cointegration test conducted using the ARDL Long Run Bound Test technique. The F-Bound test rejects the null hypothesisat5%significance level that there exits no long-run association between the variables. This is evidenced by the F-statistic being larger than UCB I(1) at the 1% and 5% significance level. Therefore, this demonstrates that there is a significant long-run relationship between the independent variables and the dependent variable.

TABLE 2: Bound test results

F-Bounds Test		**Null Hypothesis: No level relationship**		
Test Statistics	**Value**	**Significance**	**I(0)**	**I(1)**
F-statistics	7.058873	10%	2.37	3.2
K	3	5%	2.79	3.67
		2.5%	3.15	4.08

		1%	3.65	4.66

Source: Author's calculations.

Table 3: Long run results

Variables	Coefficient	SE	t-statistics
lnMYS	0.589871*	0.084511	6.979853
lnNS	-0.320471**	0.113167	-2.831847
lnESE	0.687799*	0.100363	17.13112
C	2.217560	1.717492	1.291162

Note: * and **represents 1%, and 5% level of significance.
The lag order for ARDL long-run result is (2,4,3,4).
Source: Author's calculation.

From results of long run and bound test, mean years of schooling has a significant and positive impact on the economic growth. The results are like the empirical studies by Rudolf, Kubík. (2015), Theodore, R. et. al. (2016), and Melina, Solaki. (2013). Kubik (2015) argues that higher share of uneducated population will be burden for the economy and will slow down the economic growth. Whereas Mark, Bils. (1998) in his research states that growth effects schooling and education more than education effects growth. From our findings it can be concluded that 1% increase in mean years of schooling will cause GDP per capita to rise by 0.59% approximately. Increased mean years of schooling means increased educated population which is more productive human capital, and it will lead to increase in economic growth.

Enrolment in school education also has a significant and positive relationship with the economic growth which supports the previous coefficient of MYS that more educated the people more the growth and prosperity in the country. Similar results are also suggested by existing research also supports our findings. A study by Nur, Indah, Lestari. (2017) explain the effect of government spending on education on the economic growth through the enrollment in schools. N.L., Hicks. (1987) also advocates for more investment in education and states that education contributes to economic growth through increased productivity. Our findings suggest that a 1% increase in the enrollment in schools will cause the GDP per capita to increase by 0.69% approximately.

Whereas other variable in our study the number of schools has a negative impact on GDP per capita. The negative impact of the number of schools on GDP per capita can be attributed to factors such as the quality of education provided, the alignment of educational outcomes with economic needs, and the overall institutional quality and governance in the education sector. Fomba, B. K et. al. (2022) argues that it is the quality of education that matters and not the number of schools and institutes. According to Fomba et. al. (2023), a mismatch between the skills acquired through education and the requirements of the job market can lead to a negative impact on GDP per capita. Although education leads to increase

the GDP per capita but it may not always true for every educational variable. The negative relationship between number of schools and GDP per capita can also be explained as the increase in number of schools require decent amount of investment but the schools in marginalized areas may not contribute to the economic growth.

ARDL Error Correction Regression (Short Run Analysis)

We used ECM for short term analysis (Table 4) . The coefficient for error correction (ECT_{t-1}) is shown to be negative and statistically significant at a significance level of 1%. The high coefficients suggest that the imbalance can be rectified at a faster rate in the long term, without any influence from prior year shocks in the explanatory variables. The value of the cointegration equation implies the degree of convergence, i.e. 86.02% of the variables will converge. The F-statistic contradicts the null hypothesis that the variables have no short-run relationship.

TABLE 4

Variables	Coefficient	SE	t-statistics
D (LGDP (-1))	0.671320*	0.118236	5.677808
D(NS)	0.429650*	0.048122	8.928350
D (NS (-1))	-0.295627*	0.049362	-5.989001
D(ESE)	-0.435447*	0.141711	-3.072776
D(MYS)	0.6061238**	0.240386	2.521453
D(MYS (-1))	-2.013924*	0.309606	-6.553504
ECT_{t-1}	-0.860227*	0.122376	-7.029375
R-square: 0.908802 Adjusted R-square: 0.830632			

Source: Author's calculations

StabilityAnalysis

Based on prior research conducted by Narayan and Narayan (2005), Qamruzzaman and Jianguo (2017), and Paul (2014), our study has conducted model stability testing through the utilisation of various diagnostic tests. These tests include the J-B normality test (as presented in Table 5), the LM serial correlation test (as shown in Table 6), and the B-P-G heteroskedasticity test (as displayed in Table 7). The empirical findings of this investigation demonstrated that theARDL model effectively satisfied all diagnostic examinations. Simultaneously, this study employed two stability tests, namely CUSUM and CUSUMSQ, to examine the stability of both long-term and short-term characteristics. The stability tests were originally suggested by Pesaran and Shin (1999). Figures 2 and 3 demonstrate that the stability tests' graphs are situated inside the critical limits at a significant level of 5%. This study validates the precision of both long-term and short-term variables that impact economic growth during the period spanning from 1996 to 2022.

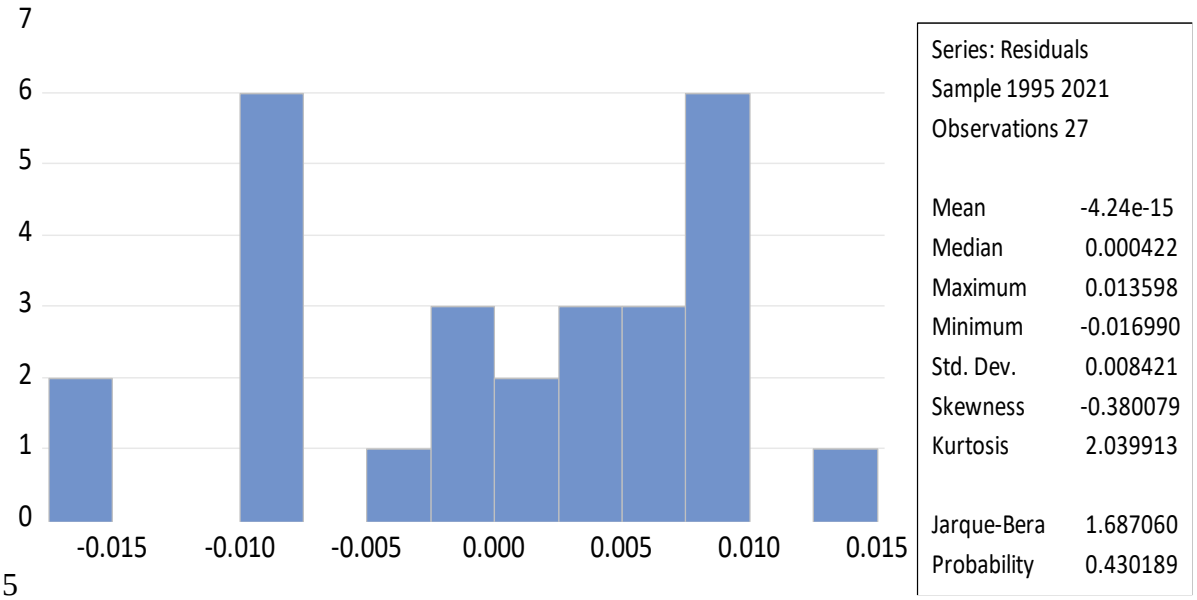


Table 5

Source: Author's calculations.

TABLE 6

Breusch-Godfrey Serial Correlation LM Test	**F-Statistics**	**p-value**
Null Hypothesis: No serial correlation at up to 2 lags	2.616132	0.1855

TABLE 7

Breusch-Pagan-Godfrey	**F-Statistics**	**p-value**
Null Hypothesis: Homoskedasticity	2.187765	0.1058

Source: Author's calculations.

FIGURE 2

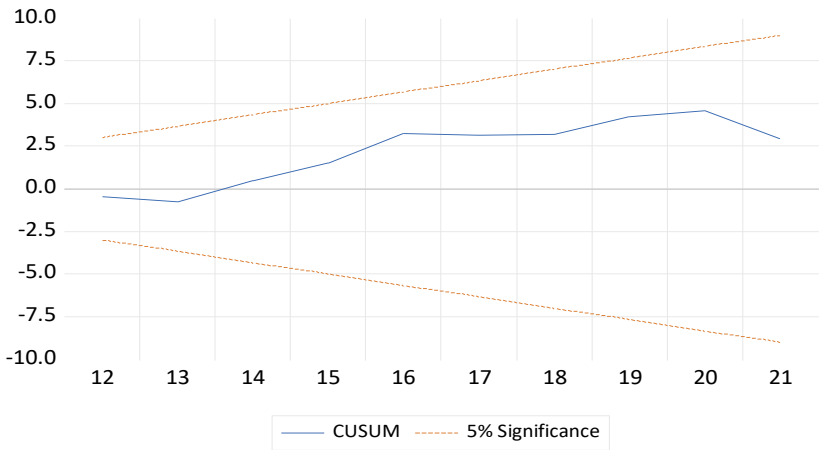
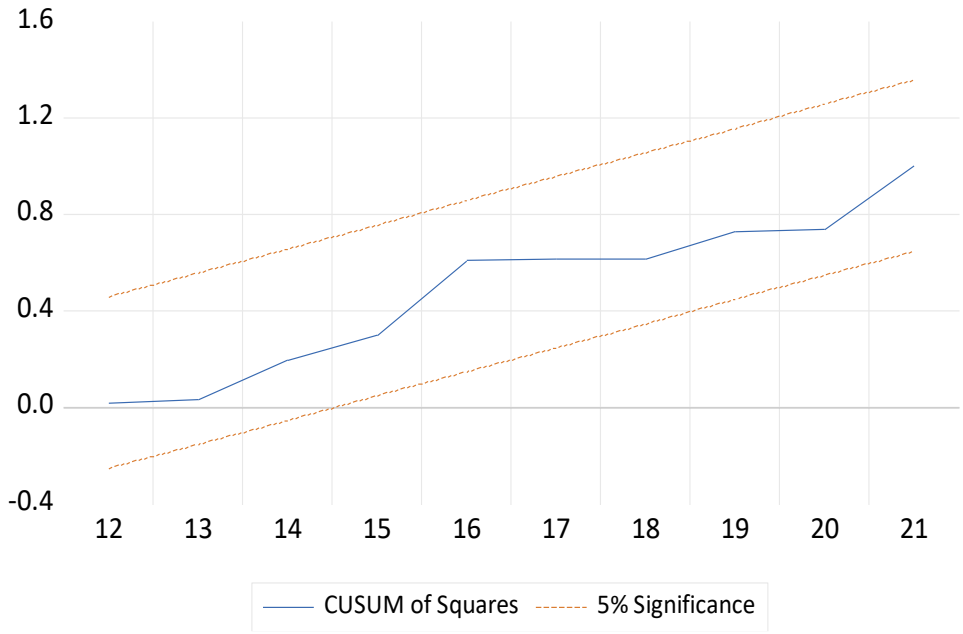


FIGURE 3



Source: Author's calculations.

Conclusion

This paper examined the short-run and long-run impact of Educational variables that are MYS, ESE, and NS on GDP per capita which is a measure of economic growth. It is found by the ARDL results that there is positive and significant relationship with dependent variable GDP and two variables namely MYS, and ESE whereas the othervariable NSshow a significant but negative relationship with dependent variable GDP. The coefficient shows that ESE has a major impact that leads to 0.69% increase in GDP per capita with 1% increase in it. Other variable MYS explains a lesser impact with 0.59% increase in GDP with 1% increase in it. Whereas the only variable that shows negative and significant impact is NS with a coefficient of 0.32%.

The long run relationship between these variables have been justified by bound test that shows F-stat greater than UBC at 1% and 5% level of significance. The short run relationship has been analyzed by ECM with a significant and negative ECT that shows 86.02% convergence in long term. The stability of the model has been confirmed using the CUSUM and CUSUMSQ tests.

Current state of educational infrastructure in India according to UDISE report 2021-2022 show that 14.89 lakh schools in India, more than 95 lakh in India, and nearly 26.52 crore students in India, which make Indian school education as the largest education system in the world. NEP-2020 open the doors for creating save and inclusive learning environment for the students. This policy majorly supports a student – centric approach to education and focus on skill development, problem solving aptitude and learning by doing. NEP introduces 5+3+3+4 school education structure. Teachers training program – teaching eligibility test, different B.Ed course with 4 year and 2 year, and also few constant professional development training programs for teachers. Distance learning program from DIKSHA and SWAYAM make distance learning and training for teachers open new dimensions in teachers training.Education for

special children becomeseasier by different steps taken by government. Currently schools are more inclusive and provide facilities for all kind of students so, will not feel separate from other students.

Currently more than 13 lack schools out of 14.8 lack provide facility of girls washroom and more than 3.8 lack schools provide facilities for children with special needs. Infrastructure facility does not include only trained teachers and curriculum but also include physical environment like – sports facility, sanitation, and classroom with proper ventilation etc. but NEP -2020 focus on all the measers.

Policy Implications:

India is in the phase of development, It is the correct time for our nation to focus on the education system and make it cost-effective so that the future prospectus of economic growth are achieved. It is observed that investment in educational infrastructure positively impact the GDP growth.Given India's status as a developing nation, it is imperative for the government to priorities the implementation of policies aimed at educational infrastructure development and promotes the GDP growth. This objective can be achieved by the more investment schools and school facilities and provide more and better resources to schools and students, as well as the establishment of school education infrastructure standards. Although the implementation of these schemes has previously taken place, the effects that followed have been positive on GDP growth. One key issue in this regard is the presence of corruption, which has a substantial impact on the implementation of policies. Monitoring and evaluating the efficacy of policies aimed at educational development is of paramount importance. This measure will contribute to the verification of policy effectiveness and its alignment with the desired objectives, as well as its responsiveness to the demands of the economy. Additionally, it is essential for the government to verify the effective use of educational resources by intermediaries. This paper further initiate for a better scope of research in this area that would be beneficial for India to strategically educational development for economic growth.

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Appendix

Data Table

Year	GDP per capita (constant 2015 US$)	MYS	Number of Schools	ENROLMENT IN SCHOOL EDUCATION
1991	528.898177	2.8849 46	1042483	150363320
1992	546.4410205	2.9883 15	1016333	156950330
1993	560.7985718	3.0916 84	1082385	154353373
1994	586.1754576	3.1950 54	1368405	151784839
1995	618.1392879	3.2984 23	1539251	163391854
1996	651.9583566	3.4675 73	1578163	167281470
1997	665.4661076	3.6367 23	1550958	170134906
1998	693.4085048	3.8058 7	1136653	174634074

		3		
1999	740.9162333	3.9750232	1060965	178293894
2000	755.482294	4.144173	1099579	182133354
2001	777.7336603	4.22123	1108439	188836645
2002	793.1009618	4.29828 7	1084675	189218510
2003	840.8180443	4.375344	1105636	202457022
2004	892.3821035	4.45240 1	1190978	212022638
2005	947.7634353	4.529459	1265687	219083879
2006	1008.667137	4.636587	1295412	222629917
2007	1070.131538	4.74371 5	1328615	228134145
2008	1087.583036	4.850844	1361621	237150741
2009	1156.880666	4.957972	1398453	240013879
2010	1238.014727	5.0651	1469870	241711063
2011	1285.283034	5.30191	1464792	248568502
2012	1337.476111	5.39910 6	1517382	257936363
2013	1404.545346	5.49630 2	1500768	254887000

2014	1490.028508	5.5934	1518160	258400000
2015	1590.174331	5.6906	1516892	259468000
2016	1701.184238	5.7878	1522386	260596960
2017	1795.91185	6.0144	1535606	251336317
2018	1891.138435	6.2409	1558903	250989193
2019	1944.314848	6.2813	1551000	248338587
2020	1813.534553	6.4948	1507708	250971683
2021	1961.960889	6.5327	1509136	253804461