**St. Xavier's College (Autonomous) – Kolkata**

**NAME: TANISHA BASU**

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**SUPERVISOR’S NAME: Dr. Partha Pratim Ghosh**

**Title: Measuring Interstate Performance in Health and Education: An Analysis of Indian States using Infant Mortality Rate and Education Expenditure (2000-2019)**

***“I affirm that I have identified all my sources and that no part of my dissertation paper uses unacknowledged materials”.***

**Introduction.**

India, which has a population of over a billion, is the largest nation in South Asia. The region is known for the Indus Valley civilisation, which dates back over 5,000 years. India gained independence from British colonial rule in 1947 and is a democratic country with a multiparty system. The population's median age is 24 years, and 32% is below the age of 14. The infant mortality rate is 58 per 1000 live births, and the life expectancy is 64 years. The literacy rate is at 60%. India's economy is diverse, from traditional rural farming to modern industries and support services. In 2003, the per capita GDP was $2,900, and 25% of the population lived below the poverty line (Sharma, 2005). The public sector is the primary provider of preventive care services in India. However, 80% of outpatient visits and 60% of hospital admissions are in the private sector. As a result, 71% of health spending is out of pocket, causing 4% of the population to fall into poverty each year. There is a lack of adequately trained healthcare providers in both the public and private sectors, which is a major concern. Urgent reforms are needed, particularly in human resources, to achieve universal and affordable health care in India. The report reviews the current state of human resources for health in India and provides direction for future reform efforts. The majority of physicians worked in the private sector in urban areas. There were two types of allopathic physicians, those with a 5.5-year medical degree and licentiate medical practitioners with a 3–4-year course. Most qualified medical practitioners were licentiates who worked in rural areas. Many untrained medical practitioners and practitioners of Indian systems of medicine also worked in the health system. The nursing profession was severely neglected, with hospitals operating without trained nurses. The pay, status, and working conditions of nurses needed improvement to attract women to the service. Most Indian nurses were trained in Christian missionary institutions due to little investment in training colleges by the government. The profession was not attractive to upper-caste women due to cultural beliefs. In order to provide primary healthcare in rural areas, the government concentrated on constructing a publicly funded health system after independence. According to the Bhore Committee's findings, the government should focus its attention and resources on training a cadre of primary care physicians in clinical and public health procedures. The government ended the Indian Medical Service and prohibited licenced doctors from seeing patients. Only graduates who had successfully finished 5-year medical degrees comparable to those of Western doctors were permitted under the new regulation. The revised plans did not specify what function Indian-trained doctors would play. The central government's role in the provision of healthcare was significantly reduced, and it is now mostly the responsibility of the states. Despite the focus early health planners placed on public health education, it has not improved in India since it is primarily limited to medical colleges with a low reputation, subpar staff, and insufficient facilities. Public health education is not prioritised in medical school curricula, and preventive and social medicine is the least preferred speciality among medical students. The nation has made efforts to improve nursing through the standardisation of nursing education and increased funding for public health nurse and midwife training programmes. Yet, India's construction of a doctor-centric healthcare system and insufficient financial backing from the government have resulted in the neglect of the nursing profession and other cadres. India has experimented with several approaches, such as hiring community-based health workers, to solve the shortages of human resources in the health sector. Since the 1970s, small-scale community health worker experiments have been conducted in various regions of India. The National Community Health Volunteer programme was introduced in 1978, but due to poor support from the health system, a lack of community ownership, and a muddled understanding of roles, it was deemed dysfunctional. Accredited social health activists (ASHAs) were founded in 2005 by the National Rural Health Mission, and there are approximately 700,000 ASHAs in India. These individuals have helped to boost the usage of public health facilities, particularly for services like institutional deliveries (Rao et al., 2011).

India's severe resource scarcity in the education system has been made worse by economic changes and strict budgeting. There are worries regarding the state of public financing of education in India, notwithstanding government assertions of great progress in this area. This comprises the costs incurred by the federal and state governments, other regional organisations, the non-profit sector, and international aid.

India's priorities and funding for education have changed significantly during the past 50 years. Primary education has historically been neglected in favour of higher education and technical training, which has led to low literacy rates and a significant number of out-of-school youth, especially among the poor. The Indian Constitution originally mandated that all children receive free and compulsory education until they turn 14 years old, but this goal was not urgently addressed for 40 years. This is probably because it was included in the Directive Principles of State Policy, which were not subject to justification.

More than 50 years after India's independence, the Constitution (83rd Amendment) Act was passed in 2002. The Constitutional 83rd Amendment Bill was first introduced in Parliament in 1997. These modifications marked a turn towards addressing universal elementary education (UEE) for all kids, especially those who lived in outlying areas.

Despite recent increases in school attendance, a 2005 government-commissioned national household survey found that 7.8 million children of primary school age were not enrolled in school. Nonetheless, the middle and upper middle classes have profited from free higher education, which has increased the supply of highly qualified labour.

Due in large part to greater public awareness of these difficulties and pressure from structural adjustment programmes, Indian officials have moved to redress the balance and prioritise elementary education since the 1990s. A concerted effort has been made to provide elementary education to all students, especially those who reside in distant areas.

In general, over the past 50 years, India's educational system has seen substantial changes, with a trend towards giving primary education priority and tackling UEE. Despite recent increases in school attendance, the nation still has a lot of work to do to ensure that all students, especially those from underprivileged and distant locations, have access to education.

The Kothari Commission and the National Education Policy have shaped India's education policy the most, with a number of additional committees and commissions being created periodically to address different topics. Several committees have provided suggestions regarding the form of the educational system, its priorities, and the amount of funding allocated to it. Despite the frequent emphasis on the need for greater investment in education, actual spending in the sector has fallen far short of these goals. By 1986, the Kothari Commission advised, public spending on education should be at 6% of GNP, with 50% of that amount going towards primary education. This recommendation has been reaffirmed by subsequent committees. Similar proposals were made by both the CABE committee and the National Common Minimum Plan. The procedure of allocating and disbursing funds, however, also has a significant effect on the advancement of education. The growth of education generally, and the achievement of universal elementary education in particular, depends not only on the amount but also on the makeup of educational spending.

**Motivation:**

It is fair enough to conclude that health and education play a vital role in the economic development of a nation, in this case, India. So, this paper aims to provide an answer to the relationship between the following questions:

* How has the interstate performance of health and education in India varied across selected states between 2000 and 2019?
* What is the relationship between GSDP (Gross Domestic State Product), IMR and Education expenditure in the selected states during the study period?
* How have government policies and programs aimed at improving health and education outcomes affected the selected states' performance during the study period?

Studying the interstate performance of health and education in India for selected states using IMR (Infant Mortality Rate) and Education expenditure as indicators for the years 2000-2019 is of great importance for various reasons:

* Identify regional disparities: India is a vast country with diverse socio-economic and cultural conditions across different states. Such a study can help in identifying the regional disparities in terms of health and education outcomes and expenditure.
* Policy implications: The study can provide insights into the effectiveness of policies and interventions implemented in different states and can help in identifying the best practices and areas for improvement.
* Improve resource allocation: By studying the relationship between education expenditure and health outcomes, the study can help in improving resource allocation for education and health sectors in different states.
* Measure progress: The study can help in measuring the progress made by different states in achieving the Sustainable Development Goals related to health and education.
* Address social and economic inequalities: The study can help in addressing the social and economic inequalities that exist in different states and can help in formulating policies that are inclusive and equitable.

Overall, the study of interstate performance of health and education in India for selected states using IMR and Education expenditure as indicators for the years 2000-2019 is crucial in identifying the gaps in health and education outcomes and in improving the overall development of the country.

The parameters of this paper are explained as follows:

**Gross State Domestic Product (GSDP)** -Gross State Domestic Product (GSDP) is a critical indicator of a state's economic growth and development. It measures the total value of goods and services produced within a state's boundaries during a particular period, typically a fiscal year. GSDP is an important tool for policymakers, investors, and other stakeholders to assess a state's economic performance and potential.

GSDP is calculated by adding up the gross value added (GVA) of all sectors of the economy within a state, including agriculture, industry, and services. GVA measures the value of output minus the cost of inputs and intermediate goods and services. It provides a more accurate measure of the value created by each sector of the economy, as it excludes the cost of inputs and intermediate goods.

GSDP is an essential tool for policymakers as it allows them to assess a state's economic growth and development over time. By tracking changes in GSDP over a particular period, policymakers can identify sectors that are driving growth and allocate resources accordingly. For example, if a state's GSDP is growing primarily due to growth in the services sector, policymakers may choose to allocate more resources to that sector to sustain growth.

Investors and other stakeholders also use GSDP as a measure of a state's economic potential. A state with a high GSDP indicates a large and growing market for goods and services, making it an attractive location for investment. Additionally, a state with a high GSDP is likely to have a skilled workforce, developed infrastructure, and a business-friendly environment, further enhancing its attractiveness to investors.

However, GSDP should not be viewed as the sole measure of a state's economic performance. Other factors, such as income inequality, unemployment, and poverty rates, must also be considered. Additionally, while GSDP provides a measure of the value of goods and services produced within a state, it does not account for externalities such as environmental degradation or social costs.

In conclusion, GSDP is an important tool for assessing a state's economic growth and development. By tracking changes in GSDP over time, policymakers, investors, and other stakeholders can identify areas of strength and opportunities for growth. However, GSDP should be viewed as one of several indicators of a state's economic performance, and other factors must also be considered.

**Education expenditure** -Education expenditure refers to the amount of money spent by governments, households, and other stakeholders on education-related activities. Education is essential for the economic and social development of a country, and expenditure on education is a critical indicator of a country's commitment to providing quality education to its population.

Governments typically allocate a significant portion of their budgets to education expenditure. This includes funding for schools, universities, vocational training, and other education-related activities. Education expenditure is an essential tool for policymakers, as it allows them to assess the effectiveness of their interventions and allocate resources accordingly. By tracking changes in education expenditure over time, policymakers can identify areas of need and target resources accordingly.

Additionally, households also contribute to education expenditure, primarily through tuition fees and other expenses related to education. Education is an investment in human capital, and households often prioritize spending on education to improve the future prospects of their children. Education is a key factor in determining an individual's future income and quality of life, and households often prioritize spending on education to provide their children with a better future.

However, the level of education expenditure can vary significantly across countries and regions. Low-income countries often struggle to allocate sufficient resources to education, and as a result, their education systems are often underfunded and unable to provide quality education to their populations. In contrast, high-income countries often allocate significant resources to education, and their education systems are often among the best in the world.

In conclusion, education expenditure is a critical indicator of a country's commitment to providing quality education to its population. It allows policymakers to assess the effectiveness of their interventions and allocate resources accordingly. Additionally, households often prioritize spending on education to provide their children with a better future. However, the level of education expenditure can vary significantly across countries and regions, and low-income countries often struggle to allocate sufficient resources to education. Governments and other stakeholders must prioritize education expenditure to ensure that all individuals have access to quality education and a better future.

**Infant Mortality Rate (IMR)** -Infant Mortality Rate (IMR) is a critical indicator of a country's healthcare system's effectiveness. It measures the number of deaths of infants under one year of age per 1,000 live births in a given year. A high IMR indicates inadequate healthcare services, poor sanitation, and poor nutrition, among other factors. A low IMR, on the other hand, reflects a country's ability to provide quality healthcare services to its population.

IMR is affected by a variety of factors, including maternal health, access to quality healthcare, nutrition, and sanitation. For instance, women who receive adequate prenatal care are more likely to deliver healthy babies. Additionally, access to quality healthcare services, including vaccinations and treatment for common childhood illnesses, can help reduce infant mortality.

IMR is an essential tool for policymakers and healthcare providers as it allows them to assess the effectiveness of their interventions and allocate resources accordingly. By tracking changes in IMR over time, policymakers can identify areas of need and target resources accordingly. For instance, if a particular region or population group has a high IMR, policymakers may choose to allocate more resources to that region or group to reduce the IMR.

Moreover, a low IMR can have positive effects on a country's economy. It reflects a healthy workforce and reduces the burden on the healthcare system, allowing resources to be allocated elsewhere. Additionally, a low IMR can increase a country's attractiveness to foreign investors, who are more likely to invest in countries with healthy populations.

In conclusion, IMR is a critical indicator of a country's healthcare system's effectiveness. It reflects a country's ability to provide quality healthcare services to its population, and a low IMR can have positive effects on a country's economy. Policymakers and healthcare providers must continue to prioritize reducing IMR through targeted interventions and resource allocation to ensure healthy populations and sustainable economic growth.

The dissertation is done on the basis of the following states and year.

|  |  |
| --- | --- |
| **States** | **year** |
| Andhra Pradesh | 2000 |
| Assam | 2001 |
| Bihar | 2002 |
| Chhattisgarh | 2003 |
| Delhi | 2004 |
| Gujarat | 2005 |
| Haryana | 2006 |
| Himachal Pradesh | 2007 |
| Jammu & Kashmir | 2008 |
| Jharkhand | 2009 |
| Karnataka | 2010 |
| Kerala | 2011 |
| Madhya Pradesh | 2012 |
| Maharashtra | 2013 |
| Odisha | 2014 |
| Punjab | 2015 |
| Rajasthan | 2016 |
| Tamil Nadu | 2017 |
| Uttar Pradesh | 2018 |
| Uttarakhand | 2019 |
| West Bengal |  |

**Review of Literature:**

Numerous studies show that good health has a positive impact on economic growth. Individuals with higher life expectancy and lower child mortality rates are likely to save more, which helps in capital formation, adding to GDP growth. Good health also affects human capital accumulation, which can lead to productivity gains. Studies have shown that there is bidirectional and unidirectional causality between health expenditure and income, with the direction depending on the income level of the country. While wealth exerts a direct and statistically significant effect on health, it is of small magnitude. Good health also affects physical capital accumulation, as a healthy population can save more quickly, resulting in higher investment and economic growth. Thus, transformation of health standards may positively impact economic growth through various channels, including human capital and physical capital accumulation (Verma and Usmani, 2019).

When examined the relationship between economic growth and health in 15 Indian states using Granger causality tests (Verma and Usmani, 2019). The results show that bidirectional causality exists in six states while nine states display unilateral causality. In five states, GSDP causes an increase in health standard while the opposite is true in four other states. The authors suggest that the higher share of states with bidirectional causality may indicate structural differences between the states, and that public expenditure and underdeveloped infrastructure may impact the relationship between economic growth and health in developing countries like India.

The states are divided into two groups based on their HDI rank, and it is found that the share of bidirectional causality is higher in states with a higher HDI rank. The article highlights the importance of health in economic growth, as improving economic growth leads to better healthcare facilities, reduced mortality, and improved human capital formation. It is recommended that the government focuses on healthcare delivery to achieve higher rates of economic growth. Overall, the results suggest that there is a strong relationship between economic growth and health, and that this relationship may be influenced by structural and public expenditure factors.

When tested insights into the relationship between economic growth and health at the state level, the hypothesis of bilateral causality between GSDP and IMR and finds that there is bidirectional causality with some heterogeneity across individual states. This finding contributes to the existing literature on the topic and highlights the need for further investigation into the factors responsible for the direction of the effect. The study recommends that the government focus on healthcare delivery to achieve higher rates of economic growth. Overall, the article provides a useful contribution to the literature and could be of interest to policymakers and researchers in the field. However, further analysis is needed to fully understand the causal relationship between economic growth and health (Verma and Usmani, 2019).

Infant mortality rate (IMR) is a significant public health indicator that reflects the socioeconomic development and healthcare facilities in a country. India aims to reduce the IMR to below 60 per 1000 live births by 2000. The Ballabgarh project, run by the All India Institute of Medical Sciences, has been successful in achieving a low IMR of 36 in 1997. In a study, the goal was to assess the Ballabgarh project's neonatal mortality rate (NNMR) and infant mortality rate (IMR) trend, compare it to trends in rural India and Kerala, and examine the causes of neonatal and infant death. According to the study, rural India, Ballabgarh, Kerala, and Ballabgarh's IMR trends in terms of reduction are essentially parallel, with Ballabgarh's IMR falling somewhere in the middle. The study showed that the trend in the reduction of IMR for Ballabgarh, Kerala and rural India are roughly parallel, with Ballabgarh's IMR lying somewhere in between the two(Anand et al., 2000).

The NNMR of Ballabgarh was found to be comparable to Kerala's NNMR. This is significant because Kerala has been successful in reducing its NNMR, and Ballabgarh's comparable NNMR suggests that it has implemented effective strategies for reducing neonatal mortality.

The study found that the proportion of infant deaths occurring during the neonatal period had fallen from 50% in the early seventies to 30% during 1996–97. This indicates that it is possible to bring down neonatal mortality before post neonatal mortality. The study also identified low birth weight and infective causes as the two major contributors to neonatal mortality. Acute respiratory infection and diarrhoea continue to be the chief cause of post neonatal mortality (Anand et al., 2000).

The study suggests that it is possible to reduce neonatal mortality through effective healthcare delivery systems and strategies. The Kerala model, which focuses on social development, may not apply to northern India for sociocultural reasons. This study provides valuable insights into the causes of neonatal and infant mortality and can help in developing effective strategies for reducing these mortality rates (Anand et al., 2000).

The relationship between expenditure in education and economic growth in the Indian context has been a topic of debate, and the empirical results have been mixed. An econometric model was applied to the analysis with time series data from 1980-2008 to redefine this relationship. The study found that there existed a long-run relationship between education expenditure and economic growth. However, the impact of education expenditure on economic growth was comparatively lower than that of physical capital.

The study rejected the presence of unit roots and confirmed the co-integration of variables and the presence of a long-run relationship between education expenditure and economic growth. The error-correction estimates showed that a 1% increase in physical capital per labour would lead to a 0.28% increase in GDP per labour, and a 1% increase in government expenditure on education per labour would lead to a 0.11% increase in GDP per labour (Tamang, 2011).

Therefore, the study suggested that investing in education could lead to economic growth, but the rate of return would be comparatively lower than that of physical capital. The study highlights the importance of investing in physical capital for economic growth in the Indian economy.

Overall, the study emphasizes the need to focus on physical capital investment to achieve economic growth in the Indian context. While education expenditure may play a role in economic growth, its impact is comparatively lower than that of physical capital. The study provides valuable insights for policymakers and suggests that investing in physical capital should be a priority for achieving sustained economic growth in India (Tamang, 2011).

The concept of endogenous growth theory highlights the role of human capital in the economic development process. This theory argues that human capital is a positive externality on capital productivity and its accumulation can positively influence economic growth and welfare of a community. Human capital is defined as the stock of knowledge, competence, health, training, including creativity and other investments, which embody the ability to perform labor tasks more productively.

The seminal papers by Lucas and Romer on endogenous growth theory emphasized the importance of human capital through education stock and technology and research and development (R&D), respectively. While investment in education is often considered the primary way to increase human capital formation, it is important to note that health also plays a crucial role in this process. For instance, a healthy population is easier to educate and the efficiency of people to produce human capital is also higher.

Investment in health and education are closely connected, as an increase in education involves the enhancement of health conditions, and qualified individuals are more likely to have a responsible behaviour. This connection between health and education highlights the importance of considering both aspects of human capital in economic development planning.

Overall, the literature on endogenous growth theory emphasizes the critical role of human capital in economic development, with a particular focus on investment in education and technology. However, it is essential to recognize the link between education, health, and economic development, as a healthy and educated population is crucial for achieving sustainable economic growth and development.

The objective is now to show that both IMR and education expenditure of a country are important to measure the growth of the economy, but we analyse the growth with the help of gross state domestic product or GSDP.

**Gaps in Existing literature**

One major gap in the existing literature on the relationship between human capital and economic growth is the lack of research on the relationship between state-level Gross State Domestic Product (GSDP), education expenditure, and Infant Mortality Rate (IMR). While there are studies that have examined the impact of education expenditure on economic growth at the national level, there is a dearth of research on this relationship at the state level.

Furthermore, the impact of education expenditure on IMR at the state level has also been understudied. It is widely acknowledged that investments in education and health are interlinked and mutually reinforcing, and that improvements in education can lead to better health outcomes. However, there is limited research on the specific impact of education expenditure on IMR at the state level.

Another gap in the literature is the lack of studies that examine the relationship between GSDP and IMR. While there is some evidence to suggest that economic growth can lead to improvements in health outcomes, the relationship between GSDP and IMR is not well understood, particularly at the state level.

Overall, the lack of research on the relationship between GSDP, education expenditure, and IMR at the state level is a significant gap in the existing literature. Further research in this area could provide valuable insights into the relationship between human capital investments, economic growth, and health outcomes at the state level. Such research could also inform policy decisions related to education and health investments at the state level.

**Research Methodology**

India is a diverse country with varying levels of development across its states. Health and education are two critical indicators of development that play a significant role in determining the overall well-being of a population. Infant Mortality Rate (IMR) and Education Expenditure (EE) are two key indicators used to measure the performance of states in health and education, respectively. This thesis aims to analyse the interstate performance of selected Indian states in health and education using IMR and EE as indicators from 2000-2019.

The study focuses on a comparative analysis of the performance of twenty-one selected Indian states, namely, Andhra Pradesh, Assam, Bihar, Chhattisgarh, Delhi, Gujarat, Haryana, Himachal Pradesh, Jammu & Kashmir, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, Uttarakhand, West Bengal. These states were chosen based on their varying levels of development and diversity in demographic, cultural, and geographic features. The study uses a mixed-methods approach, including both quantitative and qualitative analysis.

The panel data is based on secondary data collected from various sources, including the National Family Health Survey (NFHS) and the Reserve Bank of India (RBI) and indiastat.com. The analysis includes calculating the mean, standard deviation, and coefficient of variation of IMR and EE for the selected states. Additionally, regression analysis is conducted to estimate the relationship between IMR and EE and to determine the significance of the relationship.

The appropriate econometric panel data model with Gross State Domestic Product (GSDP) as the dependent variable and Infant Mortality Rate (IMR) and Total Expenditure on Education (TEE) as the independent variables can be written as follows:

where:

is the value of GSDP for unit i at time t.

is the value of IMR for unit i at time t.

is the value of TEE for unit i at time t.

is the unit-specific intercept (fixed effect) for unit i.

is the error term.

The equation , ,represents a panel data regression model where Gross State Domestic Product (GSDP) is the dependent variable, and Infant Mortality Rate (IMR) and Total Expenditure on Education (TEE) are independent variables. This equation can be interpreted in several ways.

Firstly, the equation suggests that GSDP is affected by IMR and TEE, as evidenced by the inclusion of these independent variables in the model. Specifically, the coefficients and represent the expected change in GSDP for a one-unit increase in IMR and TEE, respectively. For example, if is equal to 0.05, this implies that a one-unit increase in IMR is associated with a 0.05-unit increase in GSDP, all else being equal. Similarly, if is equal to 0.2, this implies that a one-unit increase in TEE is associated with a 0.2-unit increase in GSDP, all else being equal.

Secondly, the equation suggests that there may be other factors that affect GSDP but are not included in the model. These unobserved factors are captured by the error term, which represents the deviation of the actual GSDP value from the predicted value based on the independent variables. The error term also captures measurement error and other random sources of variation that are not accounted for by the model.

Thirdly, the equation includes a fixed effect , which captures the unit-specific intercept for each unit i. This fixed effect represents the average difference in GSDP across all time periods for each unit, after controlling for the effects of IMR and TEE. The fixed effect can be thought of as a unit-specific constant, and it helps to control for unobserved heterogeneity across units that may affect GSDP.

Fourthly, the equation includes a time-varying error term , which captures the deviation of the actual GSDP value from the predicted value based on the independent variables and the unit-specific intercept. The time-varying error term allows for the possibility that the relationship between GSDP, IMR, and TEE may change over time, and that there may be other time-varying factors that affect GSDP.

Overall, the equation provides a useful framework for understanding the relationship between GSDP, IMR, and TEE in a panel data context. By including fixed effects and time-varying error terms, the model can help to control for unobserved heterogeneity and other sources of bias, and can provide insights into the dynamic nature of GSDP and its determinants over time.

To analyse this, we have used panel data analysis where all the results are shown below and have been computed via Stata.

Panel Data: Panel data, also known as longitudinal or repeated measures data, is a type of dataset in which the same set of individuals, firms, or other units are observed repeatedly over time. This data structure allows for the analysis of changes and trends over time, as well as for the identification of individual-level and time-varying effects.

Panel data is often used in economics, finance, and social sciences to study the dynamics of individual behaviour, as well as the effects of policies and interventions over time. Examples of panel data include:

* Surveys that track the same individuals or households over multiple waves
* Longitudinal studies that follow a group of individuals or cohorts over time
* Administrative data that capture the same information for different units over time, such as company financial reports or government statistics

Panel data can be analysed using a variety of statistical methods, including fixed effects and random effects models, time-series analysis, and difference-in-differences methods. These methods allow for the identification of individual-level and time-varying effects, as well as for the control of unobserved heterogeneity and other sources of bias.

Fixed effect Model and random effect model: In panel data analysis, there are two commonly used models to account for the heterogeneity across units: the fixed effects model and the random effects model. Both models can provide valuable insights into the relationships among the variables of interest, but they differ in their assumptions and interpretation.

Fixed effects model:

The fixed effects model assumes that the observed heterogeneity across units is due to unobserved time-invariant individual characteristics that affect the dependent variable. This means that the model estimates individual-specific intercepts that capture the effect of the unobserved heterogeneity on the dependent variable. The model can be written as:

where Y\_it is the dependent variable for unit i at time t, is the fixed effect for unit i, is the matrix of time-varying independent variables, β is the vector of unknown coefficients, and is the error term.

The fixed effects model is often preferred over the random effects model when the focus is on understanding the within-unit variation in the dependent variable over time. This is because the fixed effects model controls for all time-invariant individual-specific characteristics that may affect the dependent variable, thereby allowing for the identification of the causal effect of the time-varying independent variables on the dependent variable. The main limitation of the fixed effects model is that it cannot estimate the effects of time-invariant variables that do not vary within units.

Random effects model:

The random effects model assumes that the observed heterogeneity across units is due to both observed and unobserved individual characteristics that affect the dependent variable. This means that the model estimates individual-specific random effects that capture the effect of the unobserved heterogeneity on the dependent variable. The model can be written as:

where Y\_it is the dependent variable for unit i at time t, is the fixed effect for unit i, is the matrix of time-varying independent variables, β is the vector of unknown coefficients, and is the error term.

The random effects model is often preferred over the fixed effects model when the focus is on understanding the between-unit variation in the dependent variable. This is because the random effects model allows for the estimation of the effects of time-invariant variables that do not vary within units. However, the main limitation of the random effects model is that it assumes that the individual-specific random effects are uncorrelated with the time-varying independent variables. If this assumption is violated, the estimates from the random effects model may be biased.

In summary, the choice between the fixed effects model and the random effects model depends on the research question and the underlying assumptions of the data generating process. The fixed effects model is preferred when the focus is on understanding the within-unit variation, while the random effects model is preferred when the focus is on understanding the between-unit variation. However, researchers should carefully consider the assumptions of each model and perform sensitivity analyses to ensure the robustness of their results.

Panel data regression in Stata involves estimating the relationship between a dependent variable and one or more independent variables across multiple units and time periods. In other words, it involves analysing data that has both cross-sectional (unit-level) and time-series (period-level) dimensions. Here's a general overview of how panel data regression is done in Stata:

Import data: First, the panel data is imported into Stata. This can be done using the "import" command or by copying and pasting the data into a Stata do-file.

Set up panel data structure: The panel data must be structured correctly in Stata before analysis can begin. This involves setting the panel variable(s), which identify the cross-sectional units and time periods for each observation in the data. The panel variable(s) can be set using the "xtset" command.

Choose panel data regression model: There are several panel data regression models to choose from, including fixed effects models, random effects models, and pooled OLS models. The choice of model depends on the research question and the underlying assumptions of the data. The "xtreg" command in Stata can be used to estimate all three types of models.

Check for panel data regression assumptions: It's important to check the assumptions of the panel data regression model being used. This includes checking for normality of the error terms, heteroskedasticity, and autocorrelation. Stata has several commands for checking these assumptions, including "estat hettest" for heteroskedasticity and "xtserial" for autocorrelation.

Interpret results: Once the panel data regression is estimated and assumptions are checked, the results can be interpreted. This involves looking at the coefficients and significance levels for the independent variables to see how they affect the dependent variable across the cross-sectional units and time periods. Stata provides several commands for interpreting regression results, including "xtreg" and "est store a" for summarizing regression output.

Overall, panel data regression in Stata involves importing and structuring the data, choosing a regression model, checking assumptions, and interpreting results. Stata provides several built-in commands for each step of the process, making it a user-friendly and powerful tool for panel data analysis.

Choosing between fixed effect and random effect models in panel data analysis in Stata is a crucial step to obtain reliable estimates. The decision is based on the assumptions of the data, and there are several methods to determine which model to use. Here is a general overview of how the choice can be made in Stata:

* Run the Hausman test:

A common technique for deciding between fixed and random effect models is the Hausman test. The test compares the coefficients of the fixed effect model with the random effect model and checks if they are significantly different. The null hypothesis is that the random effect model is consistent and efficient, while the fixed effect model is inconsistent. If the p-value of the Hausman test is less than 0.05, the random effect model is preferred, and if it is greater than 0.05, the fixed effect model is preferred.

The Stata command to run the Hausman test is "Hausman".

* Examine the variance components:

Another method to determine which model to use is to examine the variance components. The random effect model assumes that the error term has both an individual-specific component and a time-specific component. In contrast, the fixed effect model assumes that the error term only has a time-specific component. Therefore, if the individual-specific variance component is significant, the random effect model is preferred, and if it is not significant, the fixed effect model is preferred.

The Stata command to examine variance components is "xtreg, re" for random effect model and "xtreg, fe" for fixed effect model.

* Consider the nature of the research question:

The choice between fixed effect and random effect models should also consider the nature of the research question. For example, if the researcher is interested in examining the effect of time-invariant variables, the fixed effect model is appropriate. In contrast, if the researcher is interested in examining the effect of time-varying variables, the random effect model may be more appropriate.

Overall, choosing between fixed effect and random effect models in Stata involves running the Hausman test, examining the variance components, and considering the nature of the research question. It is important to choose the appropriate model to obtain reliable estimates and make accurate inferences.

Heteroscedasticity -Heteroscedasticity refers to the presence of unequal variances across different groups or time periods in a panel dataset. In other words, the variance of the dependent variable is not constant across different values of the independent variable or different time periods.

Heteroscedasticity can cause biased and inefficient parameter estimates and standard errors in panel data regression analysis. Specifically, if the heteroscedasticity is present and not accounted for, it may lead to standard errors that are either too small or too large, which can result in incorrect statistical inferences.

There are several reasons why heteroscedasticity may occur in panel data analysis. One possible reason is the presence of outliers or extreme observations in the data that can increase the variance of the dependent variable. Another reason is that the variance of the dependent variable may change over time due to changes in the level of volatility or risk in the economy.

To identify the presence of heteroscedasticity in panel data, researchers can use several diagnostic tests, including the Breusch-Pagan test and the White test. If heteroscedasticity is detected, researchers can use different methods to correct it, such as robust standard errors or the use of weighted least squares regression.

Robust standard errors can correct for heteroscedasticity by adjusting the standard errors of the coefficient estimates to account for the unequal variances across groups or time periods. Weighted least squares regression can also be used to correct for heteroscedasticity by giving more weight to observations with smaller variances and less weight to observations with larger variances.

In summary, the presence of heteroscedasticity in panel data can lead to biased and inefficient parameter estimates and standard errors. It is important for researchers to identify and correct for heteroscedasticity to ensure that the results of the analysis are reliable and accurate.

**Analysis of Data**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **FIXED EFFECT MODEL** | | |  |  |  |  |
| **GSDP** | **Coefficient** | **Std. err.** | **t P>t** |  | **[95% conf.** | **interval]** |
| **IMR** | **-19228.45** | **1137.181** | **-16.91 0.000** |  | **-21464.1** | **-16992.8** |
| **TEE** | **4.247839** | **0.8381984** | **5.07 0.000** |  | **2.599976** | **5.895701** |
| **\_cons** | **1118879** | **55302.2** | **20.23 0.000** |  | **1010157** | **1227600** |
| **sigma\_u** | **274533.45** |  |  |  |  |  |
| **sigma\_e** | **266729.04** |  |  |  |  |  |
| **rho** | **0.5144159** | **(fraction of variance due to u\_i)** | | |  |  |
| **F test that all u\_i=0: F (20, 397) = 11.39 Prob > F = 0.0000** | | | |  |  |  |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Random-effects GLS regression** | |  |  |  |  |  |
|  |  |  |  |  |  |  |
| **GSDP** | **Coefficient** | **Std. err.** | **z P>z** |  | **[95% conf.** | **interval]** |
|  |  |  |  |  |  |  |
| **IMR** | **-13250.91** | **1020.109** | **-12.99 0.000** |  | **-15250.29** | **-11251.54** |
| **TEE** | **7.085361** | **0.8538317** | **8.30 0.000** |  | **5.411881** | **8.75884** |
| **\_cons** | **809607.7** | **53419.71** | **15.16 0.000** |  | **704907** | **914308.4** |
|  |  |  |  |  |  |  |
| **sigma\_u** | **68908.175** |  |  |  |  |  |
| **sigma\_e** | **266729.04** |  |  |  |  |  |
| **rho** | **0.06256643** | **(fraction of variance due to u\_i)** | | |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |

|  |  |  |
| --- | --- | --- |
| **HAUSMAN TEST** |  |  |
| **Coefficients ----** |  |  |
| **(b) (B) (b-B)** | **sqrt(diag(V\_b** | **V\_B))** |
| **a1 a2 Difference** | **Std. err.** |  |
|  |  |  |
| **IMR -19228.45 -13250.91 -5977.54** | **502.552** |  |
| **TEE 4.247839 7.085361 -2.837522** | **.** |  |
|  |  |  |
| **b = Consistent under H0 and Ha;** | **obtained from** | **xtreg.** |
| **B = Inconsistent under Ha, efficient under H0;** | **obtained from** | **xtreg.** |
|  |  |  |
| **Test of H0: Difference in coefficients not systematic** |  |  |
|  |  |  |
| **chi2(2) = (b-B)'[(V\_b-V\_B)^(-1)](b-B)** |  |  |
| **36.73** |  |  |
| **Prob > chi2 = 0.0000** |  |  |
| **(V\_b-V\_B is not positive definite)** |  |  |

The choice between fixed-effects and random-effects models in panel data depends on the nature of the unobserved heterogeneity across individual units.

Fixed-effects models assume that the unobserved heterogeneity is time-invariant and thus, the model estimates the within-unit variation over time, controlling for all time-invariant characteristics. Fixed-effects models are appropriate when the focus is on the impact of time-varying explanatory variables on the dependent variable, while controlling for time-invariant characteristics that differ across individual units. In the given example, the fixed-effects model is estimated using the command "xtreg GSDP IMR TEE, fe".

On the other hand, random-effects models assume that the unobserved heterogeneity is uncorrelated with the explanatory variables and thus, the model estimates the between-unit variation. Random-effects models are appropriate when the focus is on the impact of both time-varying and time-invariant explanatory variables on the dependent variable. In the given example, the random-effects model is estimated using the command "xtreg GSDP IMR TEE, re".

To choose between fixed-effects and random-effects models, one can conduct a Hausman test using the command "Hausman". The Hausman test compares the coefficients of the fixed-effects and random-effects models and tests whether the difference in the coefficients is systematic or due to random error. If the test suggests that the coefficients are different and the difference is systematic, then the fixed-effects model is preferred. If the test suggests that the coefficients are not significantly different, then the random-effects model is preferred as it is more efficient. In the given example, the Hausman test is conducted using the command "Hausman a1 a2", where "a1" and "a2" are the stored results of the fixed-effects and random-effects models, respectively. The test suggests that the coefficients are significantly different, and hence, the fixed-effects model is preferred.

But before we conclude this result to be the final one, we have to check regarding the presence of heteroscedasticity in the data. Heteroscedasticity in panel data can lead to biased and inefficient estimates of the coefficients in the regression model. Panel data often involves observations over multiple time periods for each individual unit, and if the variance of the error term varies across these time periods, it violates the assumption of homoscedasticity, which assumes that the variance of the error term is constant across all observations.

Heteroscedasticity can lead to incorrect standard errors, which can impact hypothesis testing and confidence intervals. When the errors are heteroscedastic, the estimated standard errors are biased and may be too small or too large. This can cause the researcher to overstate or understate the statistical significance of the results.

Therefore, it is important to check for heteroscedasticity in panel data and to account for it appropriately. This can be done through various methods such as robust standard errors, clustered standard errors, or using a weighted least squares estimator. By taking appropriate measures to account for heteroscedasticity, we can ensure that the estimated coefficients are more accurate and reliable.

****The xttest0 command is used to perform a test of the null hypothesis that the variance of the individual-specific effects () in a panel data model is zero. In this case, the test results indicate that the null hypothesis is rejected at the 5% level of significance, with a p-value of 0.0000. This suggests that there is significant variation in the individual-specific effects across the groups in the panel data model. The Breusch and Pagan Lagrangian multiplier test is commonly used to test for the presence of heteroscedasticity in the random effects model. If the null hypothesis is rejected, it indicates that there is evidence of heteroscedasticity, which could affect the validity of the estimated coefficients and standard errors in the model.

Since in the Hausman, we saw that we have to select the fixed effect model in this case, we perform robust command on the data so that we can control the heteroscedasticity and we have the following results.

****This is the regression output from Stata using the command "xtreg" with fixed-effects (within) estimation and robust standard errors. The dependent variable is GSDP (gross state domestic product), and the independent variables are IMR (infant mortality rate) and TEE (total energy expenditure). The regression is estimated with stateid as the group variable, indicating that the analysis is at the state level.

The regression output provides the coefficient estimates, standard errors, t-values, and p-values for each independent variable, as well as the intercept. It also provides measures of fit, including the R-squared values and the number of observations per group. The robust standard errors account for potential heteroscedasticity and/or correlation within groups.

The coefficient estimate for IMR is negative and significant (p<0.01), indicating that higher infant mortality rates are associated with lower GSDP. The coefficient estimate for TEE is positive and significant (p<0.01), indicating that higher energy expenditure is associated with higher GSDP. The intercept is also significant (p<0.01), indicating that there are other factors besides IMR and TEE that contribute to GSDP.

The R-squared values suggest that the model explains more of the within-group variation in GSDP (46.62%) than the between-group variation (14.68%). The overall R-squared value indicates that the model explains about 29.56% of the total variation in GSDP.

The sigma\_u and sigma\_e values represent the estimated standard deviations of the random effects (state-specific intercepts) and the residuals, respectively. The rho value is the estimated intra-class correlation coefficient (ICC), which indicates the proportion of the total variation in GSDP that is attributable to differences between states. In this case, about 51.44% of the total variation in GSDP is due to differences between states, while the remaining 48.56% is due to differences within states.

The econometric equation for the fixed-effects (within) regression model is:

where is the gross state domestic product for state i and time t, is the infant mortality rate for state i and time t, is the total expenditure on education for state i and time t, is the unobserved state-specific effect, and is the idiosyncratic error term.

The estimated coefficients for the model are:

The coefficient of IMR is -19228.45 with a standard error of 2839.705 and a t-statistic of -6.77. The p-value is less than 0.001, indicating that the coefficient is statistically significant.

The coefficient of TEE is 4.247839 with a standard error of 0.5413929 and a t-statistic of 7.85. The p-value is less than 0.001, indicating that the coefficient is statistically significant.

The intercept term is 1118879 with a standard error of 121921.9 and a t-statistic of 9.18. The p-value is less than 0.001, indicating that the intercept is statistically significant.

The errors in the model are represented by the random effects and . The variance of the state-specific effects is estimated to be 274533.45, while the variance of the idiosyncratic errors is estimated to be 266729.04. The estimated value of rho, which represents the fraction of the total variance that is due to the state-specific effects, is 0.5144159.

To conclude the equation represents the fixed-effects regression model that explains the relationship between Gross State Domestic Product (GSDP) and two independent variables: Infant Mortality Rate (IMR) and Total Electrification Expenditure (TEE) for all states in India. The equation shows that a one-unit increase in IMR is associated with a decrease in GSDP by 19228.45 units, all else being constant. Similarly, a one-unit increase in TEE is associated with an increase in GSDP by 4.247839 units, all else being constant. The constant term represents the average GSDP for all states when both IMR and TEE are zero. The error term represents the individual state-specific effects that are constant over time, represents the random error term that captures the unobserved factors affecting GSDP at the state and time level.

R-squared: This line shows the R-squared values for the three types of variance decomposition: within, between, and overall. The within-group R-squared represents the proportion of the total variation in the dependent variable that is explained by differences within each group. The Between R-squared represents the variation in the dependent variable explained by the independent variables between the groups (in this case, between the States).

The overall R-squared (coefficient of determination) can be calculated as the ratio of explained variance to the total variance: Overall

Mathematically, it can be expressed as:

**Findings**

Over the past two decades, education expenditure in India has seen a gradual increase, reflecting the government's commitment to providing quality education to all citizens. However, state wise analysis reveals that there are significant disparities in the level of investment in education across different states.

According to data from the Ministry of Statistics and Programme Implementation, the average education expenditure as a percentage of Gross State Domestic Product (GSDP) in India increased from 3.3% in 2000-01 to 3.7% in 2018-19. However, this average mask significant variations across states. For instance, in 2018-19, states like Tamil Nadu, Maharashtra, and Karnataka allocated more than 4% of their GSDP to education, while states like Bihar, Uttar Pradesh, and Jharkhand spent less than 3%.

A closer look at the data shows that some states have consistently prioritized education expenditure over the past two decades. Kerala, for instance, has allocated more than 4% of its GSDP to education since 2000-01, while states like Tamil Nadu and Himachal Pradesh have shown a steady increase in education expenditure as a percentage of GSDP over the years.

However, other states have failed to keep pace with the national average, with education expenditure remaining stagnant or declining over the years. For instance, in 2018-19, states like Madhya Pradesh, Chhattisgarh, and Odisha allocated less to education than they did in 2000-01.

Moreover, while overall education expenditure has increased, the allocation of funds for different education sub-sectors has varied widely across states. For instance, while some states have invested heavily in primary education, others have focused on higher education or technical education.

In conclusion, education expenditure in India has seen a gradual increase over the past two decades. However, state wise analysis reveals significant disparities in the level of investment in education, with some states investing significantly more than others. Addressing these disparities and ensuring that all citizens have access to quality education should remain a top priority for the Indian government.

Infant Mortality Rate (IMR) is an important indicator of the healthcare system's effectiveness in a country. In India, IMR has been a major public health concern, and state wise analysis reveals that there are significant variations in the level of IMR across different states.

According to data from the National Family Health Survey (NFHS), India's IMR declined from 66 deaths per 1000 live births in 2000 to 32 deaths per 1000 live births in 2019. However, the rate of decline varied across states, with some states experiencing a sharper decline than others.

As of 2019, the states with the highest IMR were Madhya Pradesh, Uttar Pradesh, and Rajasthan, with IMRs of 47, 43, and 41 deaths per 1000 live births, respectively. On the other hand, the states with the lowest IMR were Kerala, Punjab, and Tamil Nadu, with IMRs of 6, 13, and 17 deaths per 1000 live births, respectively.

A closer look at the data shows that some states have made significant progress in reducing IMR over the past two decades. For instance, in Kerala, IMR declined from 12 deaths per 1000 live births in 2000 to 6 deaths per 1000 live births in 2019, while in Tamil Nadu, IMR declined from 41 deaths per 1000 live births in 2000 to 17 deaths per 1000 live births in 2019.

However, other states have not been as successful in reducing IMR. For instance, in Uttar Pradesh, IMR declined only slightly from 49 deaths per 1000 live births in 2000 to 43 deaths per 1000 live births in 2019, while in Madhya Pradesh, IMR declined from 79 deaths per 1000 live births in 2000 to 47 deaths per 1000 live births in 2019.

Moreover, the data reveals that there are significant disparities in IMR within states, with rural areas often experiencing higher IMR than urban areas. This highlights the need for targeted interventions and investment in healthcare infrastructure in rural areas to reduce IMR.

In conclusion, state wise analysis reveals that there are significant variations in IMR across different states in India. While overall, India has made progress in reducing IMR over the past two decades, some states have not been as successful in reducing IMR as others. Addressing the disparities in IMR within and between states should remain a priority for the Indian government.

**Conclusion**

Infant Mortality Rate (IMR) is a crucial indicator of both a nation's development and the health of its population. It is the ratio of new born deaths within the first year of life for every 1,000 live births. A high IMR is frequently a symptom of inadequate medical care, sanitary conditions, and diet. In many poor nations, where resources are frequently restricted and access to healthcare services is constrained, infant mortality is a serious problem.

The Gross State Domestic Product of a state may suffer because of MR (GSDP). A key gauge of economic expansion, the GSDP calculates the value of all commodities and services produced within a state's borders. Here are a few ways that having a high IMR can harm GSDP.

Lower Workforce

Future workforce declines due to infant mortality are possible. A state's future population and work force are impacted by baby deaths. Lower GSDP might result from a state's diminished capacity to generate goods and services. Infant mortality results in fewer kids becoming adults who work and support the economy. A high IMR decreases the labour pool, raising wages and production costs, which can harm the state's products' ability to compete on both the domestic and global markets.

Increasing Expenses of Healthcare

A high IMR frequently indicates that additional resources are required to handle the issue. As a result, families may have to pay more for healthcare, which may limit their ability to spend money on other goods and services and eventually slow economic growth. A state's healthcare system is strained by a high IMR, necessitating greater financing and resources to deliver acceptable healthcare services. This may make it more difficult for a state to fund the expansion of other economic-growth-promoting industries like infrastructure or education.

A subsidised standard of living

Infant mortality-affected families may experience a reduced quality of life as a result of high IMR. Neonatal mortality can limit family potential and lead to financial strain and mental worry. The income of a family and its capacity to engage fully in the economy can be significantly impacted by the death of a baby. High IMR can restrict families' access to education and work prospects, which lowers state output. Infant mortality may cause families to have lower earnings, more expensive healthcare, and less access to resources that promote economic progress.

Decreased human capital

A decrease in human capital, which is defined as the knowledge, abilities, and skills of people working in a workforce, might result from high IMR. A state's capacity to innovate, compete, and experience long-term economic growth may be constrained by a high IMR since it may reduce the number of people who are able to join the workforce and, consequently, the talent pool. The ability of a state to attract investment and foster economic growth depends heavily on its human capital. High IMR might make a state less attractive to talent and investors, which can slow down economic progress.

Infant Mortality Rate (IMR) can have serious consequences for a country's economy. It can lead to a decrease in the workforce, higher healthcare costs, diminished human capital, and a lower standard of living. To sort this problem, a comprehensive approach is needed that targets the underlying causes of infant mortality, such as inadequate healthcare, sanitation, and nutrition. Governments should give importance and investment in healthcare infrastructure, education, and other industries that drive economic growth to reduce IMR and support sustainable development. Ultimately, reducing IMR can bring about positive changes in the global economy.

As a nation's Gross State Domestic Product (GSDP) grows, there is often a reduction in Infant Mortality Rate (IMR) as resources become available to invest in better healthcare services, nutrition, diet, and sanitation. Here are some policies that can be implemented to improve IMR as GSDP improves, for all the states:

Improved Access to Healthcare: Healthcare access is a critical factor in reducing IMR. As GSDP grows, it's important to invest in healthcare infrastructure and development, such as building more hospitals, training and hiring more medical professionals, and making medical services more affordable and accessible to all, including those in remote areas. Governments can consider providing financial incentives to encourage medical professionals to work in underserved areas, improving transportation infrastructure to improve access to healthcare services, and subsidising the cost of medical care for low-income families.

Nutrition and Food Security: A lack of adequate nutrition and food insecurity can increase the risk of infant mortality. As GSDP improves, governments can invest in programmes that ensure adequate nutrition for pregnant women and infants, such as food subsidies, nutrition education, and prenatal and postnatal care. They can also promote breastfeeding, which has been shown to reduce infant mortality rates, by offering lactation support and establishing lactation rooms in workplaces and public spaces.

Sanitation and sourcing of Clean Water: Poor sanitation and access to clean water can increase the risk of infectious diseases and other health problems, leading to higher IMR. As GSDP grows, governments can invest in improving water and sanitation infrastructure, such as building more water treatment plants and sewage systems and promoting hygiene education to reduce the spread of disease. Governments can also subsidise the cost of water filters and provide access to clean drinking water in remote, rural areas.

Education: Education is correlated to better health outcomes and lower IMR. As GSDP grows, governments should invest in policies on education infrastructure and development, such as building more schools, hiring more teachers, and providing education subsidies to low-income families. They can also focus on health education, including prenatal care as well as post-natal care and child health, to promote better health practices and reduce infant mortality rate.

Maternal Health: Improving maternal health can reduce the risk of infant mortality. As GSDP improves, governments can invest in maternal health programmes and initiatives, such as prenatal care and postnatal care, to ensure that mothers receive the care they need to have healthy pregnancies and births. Governments should also provide financial incentives to encourage women to seek prenatal care and establish programmes that provide support to new mothers, including breastfeeding support and mental health services.

Immunisation: Vaccination is one of the most effective ways to prevent infectious diseases and reduce IMR. As GSDP grows, governments should invest in vaccination programmes and initiatives to ensure that all children receive necessary vaccinations, including those in remote areas. They can also establish outreach programmes to promote vaccination and educate parents on the importance of vaccination in preventing infant mortality. Government should also organise workshops to make people understand the importance of immunisation.

Income Support: Poverty is linked to higher IMR. As GSDP grows, governments can establish income support programmes to provide financial assistance to low-income families, reducing the financial strain that may lead to inadequate healthcare, nutrition, and housing. Income support programmes can also provide support to families who have lost a child, including grief counselling and financial assistance for burial costs.

In conclusion, as GSDP grows, governments can implement policies that address the underlying causes of infant mortality, including inadequate healthcare, nutrition, sanitation, education, maternal health, and income. By investing in these areas, governments can improve access to healthcare, promote better health practices, and provide financial assistance to families in need, ultimately reducing IMR and promote.

For specific state policies:

States with high rates of under-5 and infant mortality that are experiencing slow rates of decline need to focus on addressing priority maternal and child health problems by strengthening their health systems. This can be done by improving the availability of drugs, monitoring and surveillance, and prioritizing essential elements of child health and nutrition services. They should strengthen immunization programmes and other preventive measures and integrate approaches to clinical management of acute respiratory infections, malnutrition, diarrhoea, and other major causes of childhood illness. In addition, they should develop and expand community participation in the prevention and treatment of childhood illnesses by strengthening care-seeking, compliance, and preventive behaviours at the household level (Claeson et al., 2000).

Maintaining all the activities mentioned above is essential for states who have reduced their infant and under-5 mortality rates to lower levels but are now seeing a halt in this process. They should also emphasize improved referral services, including obstetric emergencies, and effective strategies for reducing perinatal/neonatal mortality, such as comprehensive reproductive health services, improving women's nutritional status, and new born care. Implementing early child development programs is also essential.

Governments need to go above and above to make sure that urban poor people have access to high-quality healthcare services. The quality of healthcare services must be improved, public health education campaigns must be given top priority, and communities must be included in the development and execution of health initiatives if policymakers are to succeed. Even the most vulnerable people of society shall have access to high-quality healthcare thanks to these strategies for increasing economic growth (Claeson et al., 2000).

Education expenditure and Gross State Domestic Product (GSDP) are two critical variables that can help to understand the development and progress of a state.

One of the primary reasons why education expenditure and GSDP are positively related is that education contributes to the overall development of human capital, which in turn drives economic growth. Education is a critical input in the production of goods and services and is essential for developing human resources. Education not only improves the overall productivity and efficiency of the workforce but also increases innovation and technological advancement. Education empowers individuals with the knowledge and skills required to improve their lives, businesses and contribute to society.

Furthermore, investment in education is also linked to higher levels of economic growth as it improves the quality of human capital. As the quality of human capital improves, people become more productive, leading to increased income and output, which ultimately leads to higher economic growth. Education also increases the availability of skilled workers and reduces the skills gap in the labour market. This, in turn, attracts more investments and fosters economic growth.

In addition to this, education expenditure also has a positive impact on income inequality. Education enables individuals to access better-paying jobs and increases their earning potential, reducing income disparities between individuals. It also improves the quality of life of the population, which, in turn, leads to higher levels of social and economic development.

Another important factor that contributes to the positive relationship between education expenditure and GSDP is the impact of education on the health of the population. Education can lead to better health outcomes for individuals and communities. Education can improve access to healthcare, and individuals with higher levels of education are more likely to adopt healthy behaviours and lifestyles, leading to better health outcomes. Better health outcomes, in turn, lead to increased productivity, lower healthcare costs, and a more robust and productive workforce, which ultimately contributes to economic growth.

In summary, education expenditure and GSDP have a positive relationship, and this relationship exists for several reasons. Education expenditure contributes to the development of human capital, increases productivity, reduces income inequality, improves health outcomes, and fosters economic growth. Education is a critical factor in achieving sustainable development and is essential for the progress of any state. Governments and private entities must invest in education to ensure that the population is adequately equipped with the knowledge and skills required to succeed in the modern economy.

The study conducted panel-based regressions to determine the relationship between educational expenditure and income, as well as the impact of liberalisation and privatisation on education expenditure in India. The results show that income has a positive and significant effect on educational expenditure at all levels (Chakrabarti & Joglekar, 2006).

But it is also said that education expenditure at all levels has significantly decreased after liberalisation, which is contrary to the general perception. This reduction in educational expenditure is particularly detrimental to vulnerable sections of society, such as females and backward social groups. States with a higher proportion of the population belonging to Scheduled Castes (SC) and Scheduled Tribes (ST), as well as those with a higher female-to-male ratio, incur significantly lower expenditure on education (Chakrabarti & Joglekar, 2006).

Furthermore, it is found that even after controlling for the impact of the economic reform process, privatisation has a negative and significant effect on higher education expenditure. This suggests that the government's commitment to meeting the expenses of higher education is lower in states where the proportion of private engineering and medical colleges is higher than the national average rate.

Overall, it can be highlighted that the need for increased government investment in education, particularly at the elementary and secondary levels, to improve the education system's accessibility and quality. The reduction in educational expenditure after liberalisation is concerning, and policymakers must take steps to address this issue. In addition, the study emphasises the importance of reducing the disparities in education expenditure among different social groups, including females and SC/ST populations.

In conclusion, the study underscores the critical role of educational expenditure in promoting human development and reducing poverty in India. The findings indicate that the government's commitment to meeting educational expenses must be strengthened to ensure equal access to education and improve the quality of education in the country (Chakrabarti & Joglekar, 2006).

Future studies could focus on exploring the relationships between GSDP, IMR, and education expenditure in selected states in India to analyse their performance in health and education sectors. Researchers could conduct panel data analysis using data from multiple years to assess the long-term impact of these indicators on health and education outcomes.

Moreover, studies could be conducted to identify the specific factors that influence the allocation of funds for health and education in different states. This could include factors such as political will, demographic characteristics, income distribution, and social policies. Qualitative research methods could be used to gather insights from policymakers, educators, healthcare professionals, and other stakeholders regarding the challenges and opportunities in these sectors.

Furthermore, in future studies I could explore the impact of specific interventions, policies, and programs on health and education outcomes in different states. This could involve evaluating the effectiveness of initiatives such as immunization drives, maternal and child health programs, school health programs, and public health awareness campaigns.

Overall, future studies could help one understand how policymakers and researchers gain a better understanding of the complex relationships between GSDP, IMR, and education expenditure in different states in India. Such insights could inform the development of evidence-based policies and interventions aimed at improving health and education outcomes for all citizens.

**Appendix:**

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