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A Comparative Study of Correlational Analysis between Government's Expenditure on Education and Resultant Economic Growth & Development of World's Top 5 Economies by GDP from 2006 to 2020

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ABSTRACT

Education is a cornerstone of national development, playing a crucial role in shaping economic progress and human well-being. **Government expenditure on education** is often regarded as an investment in **human capital**, with potential long-term benefits for **economic growth and development**. This study conducts a **comparative correlational analysis** to examine the relationship between government expenditure on education and the subsequent economic growth and **human development** of the world's **top five economies**—United States, China, Japan, Germany, and India—over the period 2006 to 2020.

This research employs Karl Pearson's coefficient of correlation to quantify the relationship between government education spending (as a percentage of GDP) and two key economic indicators: **GDP growth** rate in the following year and **Human Development Index (HDI)** values. Data for this analysis was sourced from reputable international databases, including the World Bank and the **United Nations Development Programme (UNDP)**. The study aims to provide empirical insights into how education investments influence economic expansion and human well-being across different economic models.

The results indicate significant variations among countries in the correlation between education expenditure and economic growth. The correlation coefficients between education spending and GDP growth suggest a mixed impact: Japan shows a weak positive correlation (0.392), while the United States (-0.107), India (-0.055), and China (-0.721) exhibit negative correlations. This suggests that increased government spending on education does not necessarily lead to immediate economic growth and may depend on other structural factors, including labor market efficiency, industrial policy, and economic diversification.

Conversely, the correlation between education expenditure and HDI reveals a more positive trend, emphasizing the role of education in long-term human development. India (0.931) and China (0.79) demonstrate a strong positive relationship between government education investment and HDI improvement, followed by Germany (0.715). However, Japan (-0.538) and the United States (-0.736) present negative correlations, possibly due to the influence of other social and economic factors affecting human development beyond education expenditure alone.

These findings underscore the complex and **multi-dimensional impact of education funding**. While increased spending on education may not yield immediate GDP growth, it contributes significantly to human capital formation and overall societal well-being. The discrepancies in correlation across different economies highlight the need for country-specific policy approaches that integrate education funding with labor market strategies, technological advancements, and economic planning.

This study contributes to the existing literature by providing a comparative analysis of leading economies, offering valuable insights for policymakers, economists, and educators. It suggests that while education investment remains crucial, its effectiveness in driving economic and human development depends on complementary policies that enhance the quality of education, skills utilization, and economic infrastructure. Future research could explore additional factors influencing these relationships, such as education quality, labor productivity, and government policy frameworks.

Keywords: - Government Expenditure on Education, Economic Growth and Development, Top Five Economies, Comparative Correlational Analysis, Multi-dimensional Impact of Educational Funding.

INTRODUCTION

Education is the building block of Nations. A good educational system and educational level of the society ensures Growth as well as Development of countries. As we all know that Human Resource is the most important one as it can make and convert potential things to resources and this requires the man to be educated, logical, knowledgeable and ethical. An educated person not only can use the resources effectively but also save them for a sustainable future.
Educational expenditure of the countries is the most important factor to build the educational infrastructure as it provides monetary resource and support to educational organisations so that they can grow their quality of education they provide. Educational expenditure as a share of GDP is a very good indicator to analyse how much a country is committed towards its educational growth and quality. As the GDP grows with time its seen that educational expenditure by the governments of various countries reduces their educational expenditure as a share of GDP but not in absolute terms. Educational expenditure helps country to grow quantitatively as well as qualitatively, this also affects the human development in the society, a good indicator of which is Human Development Index or simply HDI by United Nations Development Programme or UNDP. These all data points of every country is sufficient to give us results about the partial correlation between expenditure of education and the resultant economic growth and development of the countries.

Government total expenditure on education as a share of GDP: -
General government expenditure on education (current, capital, and transfers) is expressed as a percentage of GDP. It includes expenditure funded by transfers from international sources to government. General government usually refers to local, regional and central governments.

Government expenditure on education, total (% of GDP) is calculated by dividing total government expenditure for all levels of education by the GDP, and multiplying by 100. Aggregate data are based on World Bank estimates. Data on education are collected by the UNESCO Institute for Statistics from official responses to its annual education survey. All the data are mapped to the International Standard Classification of Education (ISCED) to ensure the comparability of education programs at the international level. The current version was formally adopted by UNESCO Member States in 2011. GDP data come from the World Bank.

The reference years reflect the school year for which the data are presented. In some countries the school year spans two calendar years (for example, from September 2010 to June 2011); in these cases the reference year refers to the year in which the school year ended (2011 in the example).

The percentage of government expenditure on education to GDP is useful to compare education expenditure between countries and/or over time in relation to the size of their economy; A high percentage to GDP suggests a high priority for education and a capacity of raising revenues for public spending. Note that government expenditure appears lower in some countries where the private sector and/or households have a large share in total funding for education.

Data may refer to spending by the ministry of education only (excluding spending on educational activities by other ministries).

GDP Growth Rate:-
Annual percentage growth rate of GDP at market prices based on constant local currency. Aggregates are based on constant 2015 prices, expressed in U.S. dollars. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources.
Gross domestic product (GDP) represents the sum of value added by all its producers. Value added is the value of the gross output of producers less the value of intermediate goods and services consumed in production, before accounting for consumption of fixed capital in production. The United Nations System of National Accounts calls for value added to be valued at either basic prices (excluding net taxes on products) or producer prices (including net taxes on products paid by producers but excluding sales or value added taxes). Both valuations exclude transport charges that are invoiced separately by producers. Total GDP is measured at purchaser prices. Value added by industry is normally measured at basic prices. When value added is measured at producer prices.

Growth rates of GDP and its components are calculated using the least squares method and constant price data in the local currency. Constant price in U.S. dollar series are used to calculate regional and income group growth rates. Local currency series are converted to constant U.S. dollars using an exchange rate in the common reference year.

An economy's growth is measured by the change in the volume of its output or in the real incomes of its residents. The 2008 United Nations System of National Accounts (2008 SNA) offers three plausible indicators for calculating growth: the volume of gross domestic product (GDP), real gross domestic income, and real gross national income. The volume of GDP is the sum of value added, measured at constant prices, by households, government, and industries operating in the economy. GDP accounts for all domestic production, regardless of whether the income accrues to domestic or foreign institutions.

Each industry's contribution to growth in the economy's output is measured by growth in the industry's value added. In principle, value added in constant prices can be estimated by measuring the quantity of goods and services produced in a period, valuing them at an agreed set of base year prices, and subtracting the cost of intermediate inputs, also in constant prices. This double-deflation method requires detailed information on the structure of prices of inputs and outputs.

In many industries, however, value added is extrapolated from the base year using single volume indexes of outputs or, less commonly, inputs. Particularly in the services industries, including most of government, value added in constant prices is often imputed from labor inputs, such as real wages or number of employees. In the absence of well defined measures of output, measuring the growth of services remains difficult.

Moreover, technical progress can lead to improvements in production processes and in the quality of goods and services that, if not properly accounted for, can distort measures of value added and thus of growth. When inputs are used to estimate output, as for nonmarket services, unmeasured technical progress leads to underestimates of the volume of output. Similarly, unmeasured improvements in quality lead to underestimates of the value of output and value added. The result can be underestimates of growth and productivity improvement and overestimates of inflation.

Informal economic activities pose a particular measurement problem, especially in developing countries, where much economic activity is unrecorded. A complete picture of the economy requires estimating household outputs produced for home use, sales in informal markets, barter exchanges, and illicit or deliberately unreported activities. The consistency and completeness of such estimates depend on the skill and methods of the compiling statisticians.

Rebasing of national accounts can alter the measured growth rate of an economy and lead to breaks in series that affect the consistency of data over time. When countries rebase their national accounts, they update the weights assigned to various components to better reflect current patterns of production or uses of output. The new base year should represent normal operation of the economy - it should be a year without major shocks or distortions. Some developing countries have not rebased their national accounts for many years. Using an old base year can be misleading because implicit price and volume weights become progressively less relevant and useful.

To obtain comparable series of constant price data for computing aggregates, the World Bank rescales GDP and value added by industrial origin to a common reference year. Because rescaling changes the implicit weights used in forming regional and income group aggregates, aggregate growth rates are not comparable with those from earlier editions with different base years. Rescaling may result in a discrepancy between the rescaled GDP and the sum of the rescaled components. To avoid distortions in the growth rates, the discrepancy is left unallocated. As a result, the weighted average of the growth rates of the components generally does not equal the GDP growth rate.

Human Development Index: -

The Human Development Index (HDI) is a statistical composite index of life expectancy, education (mean years of schooling completed and expected years of schooling upon entering the education system), and per capita income indicators, which is used to rank countries into four tiers of human development. A country scores a higher level of HDI when the lifespan is higher, the education level is higher, and the gross national income GNI (PPP) per capita is higher. It was developed by Pakistani economist Mahbub ul-Haq and was further used to measure a country's development by the United Nations Development Programme (UNDP)'s Human Development Report Office.

The origins of the HDI are found in the annual Human Development Reports produced by the Human Development Report Office of the United Nations Development Programme (UNDP). These annual reports were devised and launched by Pakistani economist Mahbub ul-Haq in 1990, and had the explicit purpose "to shift the focus of development economics from national income accounting to people-centered policies". He believed that a simple composite measure of human development was needed to convince the public, academics and politicians that they can, and should, evaluate development not only by economic advances but also improvements in human well-being.

Research Objective

1. To examine the annual trends in government expenditure on education (as a percentage of GDP) in the selected countries from 2006 to 2020.
2. To analyse the correlation between education expenditure and GDP growth rate (lagged by one year) in each of the selected countries.

3. To analyse the correlation between educational expenditure and Human Development Index (HDI) scores (lagged by one year) in each country.
4. To compare and contrast the nature and strength of correlation (educational expenditure with GDP growth rate and HDI) across the five countries.
5. To evaluate whether higher government expenditure on education leads to consistent positive development outcomes, or if the relationship is more complex and variable.
6. To contribute to the academic literature by providing a lagged, dual-indicator, comparative model for analysing education investment impacts across different economies.

Research Coverage

1. Five major world economies ranked among the top by GDP, representing both developed and emerging economies and reflecting diverse political systems, cultural contexts, educational models and development pathways. These countries are- United States, Germany, Japan, China, India.
2. Time period of the data analysed is 2006 to 2020, a 15 years period.
3. The study employs a quantitative analytical framework, using Karl Pearson's coefficient of correlation to evaluate the strength and direction of the relationship.
4. Government Expenditure on Education (as a % of GDP) is taken as an independent variable while the next year GDP Growth Rate and next year HDI was taken as dependent variables.
5. Major Data sources were employed from World Bank, UNESCO Institute of Statistics and United Nations Development Programme (UNDP).

- **Significance of the Research**

1. Informing Public Debate and Stakeholder awareness.
2. Academic value and literature contribution.
3. Significance for developing countries and emerging economies.
4. Contribution to Sustainable Development Goals (Goal-4, Goal-8, Goal-10).
5. Comparative cross country insight.
6. Evidence based Policy formulation and decision making.

RELATED RESEARCH STUDIES

- Lyudmila Oleynikova (2019), studied the **Methodological approaches to funding tertiary educational institutions given the relationship between GDP and Budget expenditure on education** and found that an increase in the consolidated Budget expenditure on education by 1% results in an increase in the GDP by 1.02%.
- Ejiogu Uche (2013) studied the **Causal relationship between Nigerian government fund allocation to the education sector and economic growth** and found that educated manpower leads to economic growth and higher productivity.
- Raluca DRACEA (2009) studied **Is there any correlation between the economic growth and budget expenditure allocated to education? Case study of Romania** and found that the economic growth in Romania may be positively influenced through funds for the educational system.

MATERIALS AND METHODS USED

Correlational analysis between the government's total expenditure on education as a share of GDP and the GDP growth we get on next year along with the same analysis between government's total expenditure on education and the next year HDI value for the country is done in the paper through the usage of various data points and formulas which are as follows:

- **Data source for Government's total expenditure on education as a percentage of their respective GDPs**

The data is extracted from the DATABANK of the World Bank Website:

	USA	CHINA	JAPAN	GERMANY	INDIA
2006	6.16	2.44	3.28	4.03	3.14
2007	6.24	2.7	3.28	4.92	3.2
2008	6.44	3.63	3.27	4.55	3.25
2009	6.74	3.75	3.56	4.34	3.28
2010	6.69	3.56	3.6	5.1	3.38
2011	6.5	3.81	3.61	4.98	3.8
2012	6.25	4.3	3.42	4.93	4.08

2013	6.23	4.13	3.41	4.94	3.84
2014	6.13	4.11	3.42	4.92	3.9
2015	4.93	4.24	3.31	4.86	4.11
2016	4.78	4.21	3.15	4.84	4.26
2017	5.09	4.11	3.13	4.87	4.31
2018	4.9	4.02	3.08	4.98	4.38
2019	4.96	4.06	3.16	5.12	3.9
2020	5.4	4.23	3.31	5.59	4.04

Data Source for GDP Growth

The data is extracted from the DATABANK of the World Bank Website:

	USA	CHINA	JAPAN	GERMANY	INDIA
2007	2	14.23	1.48	2.89	7.66
2008	0.11	9.65	-1.22	0.91	3.09
2009	-2.58	9.4	-5.69	-5.55	7.86
2010	2.7	10.64	4.1	4.15	8.5
2011	1.56	9.55	0.02	3.76	5.24
2012	2.29	7.86	1.37	0.47	5.46
2013	2.12	7.77	2.01	0.39	6.39
2014	2.52	7.43	0.3	2.17	7.41
2015	2.95	7.04	1.56	1.65	8
2016	1.82	6.85	0.75	2.29	8.26
2017	2.46	6.95	1.68	2.72	6.8
2018	2.97	6.75	0.64	1.12	6.45
2019	2.58	5.95	-0.4	0.99	3.87
2020	-2.16	2.24	-4.5	-4.1	-5.78
2021	6.06	8.45	2.56	3.67	9.69

- **Data Source for Economic Development (HDI)**

The data is extracted from the UNDP website.

	USA	CHINA	JAPAN	GERMANY	INDIA
2007	0.911	0.678	0.9	0.923	0.55
2008	0.912	0.689	0.901	0.926	0.557
2009	0.913	0.698	0.9	0.925	0.562
2010	0.916	0.706	0.903	0.929	0.572
2011	0.918	0.715	0.902	0.935	0.586
2012	0.92	0.723	0.906	0.937	0.594
2013	0.922	0.732	0.909	0.938	0.6
2014	0.923	0.741	0.91	0.942	0.611
2015	0.924	0.749	0.913	0.941	0.619
2016	0.926	0.757	0.914	0.941	0.63
2017	0.928	0.766	0.916	0.944	0.636
2018	0.93	0.775	0.917	0.946	0.636
2019	0.933	0.781	0.918	0.951	0.638

2020	0.923	0.785	0.917	0.948	0.638
2021	0.921	0.788	0.92	0.948	0.633

Correlational Analysis

If two quantities vary in such a way that movements in one are accompanied by movements in the other, these quantities are called correlated. The degree of relationship of variables under consideration is measured through the correlational analysis. The measure of correlation is called as the coefficient of correlation or correlational index summarizes in one figure the direction and degree of correlation. The correlational analysis refers to the techniques used in measuring the closeness of the relationship between the variables.

Whether correlation in positive (direct) or negative (inverse) would depend upon the direction of change of the variables. If both the variables are varying in the same direction, correlation is said to be positive. If on the other hand, variables are varying in opposite directions, correlation is said to be negative.

Karl pearson's coefficient of correlation

Of the several mathematical methods of measuring correlation, the karl pearson;s method, popularly known as Pearson's Coefficiet of correlation, is most widely used in practice. The pearson's coeff. Of correlation is denoted by symbol r. the formula for computing pearsonian r is:

$$r = \frac{\Sigma XY}{\sqrt{\Sigma x^2 * \Sigma y^2}}$$

Where,
r = karl pearson's coefficient of correlation
Σxy = sum of the products of the deviations from the respective means
Σx^2 = sum of the squares of the deviations of x from its mean
Σy^2 = sum of the squares of the deviations of y from its mean

DISCUSSION AND RESULTS

Here, we are trying to find out the degree and direction of correlation between the **Government's total expenditure on education as a share of GDP** and the resultant Economic Growth which is represented by its indicator **Annual GDP Growth of next year.**

Now let the variables be as
X = Government's total expenditure on education as a share of GDP and,
Y = Annual GDP Growth of next year

Coefficient of correlation between X and Y of UNITED STATES = **-0.107**
Coefficient of correlation between X and Y of CHINA = **-0.721**
Coefficient of correlation between X and Y of JAPAN = **0.392**
Coefficient of correlation between X and Y of GERMANY = **0.006**
Coefficient of correlation between X and Y of INDIA = **-0.055**

Now, we another degree and direction of correlation between the **Government's total expenditure on education as a share of GDP** and resultant Economic Development which is represented by its indicator **Human Development Index value of next year.**

Now let the variables be as

X = Government's total expenditure on education as a share of GDP and,
Z = Human Development Index value of the next year

Coefficient of correlation between X and Z of UNITED STATES = **-0.736**
Coefficient of correlation between X and Z of CHINA = **0.79**
Coefficient of correlation between X and Z of JAPAN = **-0.538**
Coefficient of correlation between X and Z of GERMANY = **0.715**
Coefficient of correlation between X and Z of INDIA = **0.931**

Ranking based on values

RANKING	R (GROWTH)	R (DEVELOPMENT)
1	JAPAN 0.392	INDIA 0.931
2	GERMANY 0.006	CHINA 0.79
3	INDIA -0.055	GERMANY 0.715
4	UNITED STATES -0.107	JAPAN 0.538
5	CHINA -0.721	UNITED STATES -0.736

CONCLUSION

As we have seen that all the values of correlation between X and Y (X- Government's total expenditure on education as a share of GDP and Y- Annual GDP Growth of next year) are ranked above and it can be observed easily that next year GDP growth of India, United States and China are negatively correlated with the governments total expenditure on education as a share of GDP and the highest correlational value is achieved by Japan and the least by China.

The correlation between X and Z (X- Government's total expenditure on education as a share of GDP and Z- Human Development Index value of the next year) showed that the value of next year's HDI is positively related with the government's total expenditure on education as a share of GDP except one which is United States. The most correlated country is India with the value 0.931 that means very high degree of direct correlation is there.

REFERENCES

[1] Gupta Dr.S.P. (2021), Statistical Methods, Sultan Chand And Sons New Delhi.
[2] Kothari C.R., Garg Gaurav (2023), Research Methodology Methods And Techniques, New Age International Publishers.
[3] Puri V.K, Misra S.K., (2021), Indian Economy, Himalaya Publishing House.
[4] Singh Ramesh (2024), Indian Economy, McGraw Hill Education (India) Private Limited.
[5] https://www.wikipedia.org/
[6] https://www.worldbank.org/ext/en/home
[7] https://databank.worldbank.org/
[8] https://globalpeoservices.com/top-15-countries-by-gdp-in-2024/
[9] https://www.undp.org/
[10] https://www.imf.org/en/Home
[11] https://scholar.google.com