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# IMPACT OF HEALTH EXPENDITURES ON ECONOMIC GROWTH: EVIDENCE FROM SOUTH ASIAN COUNTRIES

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**ABSTRACT**

This study empirically investigates the impact of healthcare expenditure and key health outcomes on the economic growth of South Asian countries using panel data from 2000 to 2022. Employing fixed-effects and random-effects models, the analysis quantifies the relationship between health investment and GDP growth. Descriptive statistics show that the average health expenditure across countries was 3.1% of GDP, while the average life expectancy reached 68.5 years during the study period. Regression results reveal that a 1% increase in healthcare expenditure leads to a 0.52% rise in GDP growth ($p < 0.01$), indicating a significant impact. Among health outcomes, life expectancy has a positive effect on economic development, with a coefficient of 0.39 ($p < 0.05$). At the same time, infant mortality rate shows a negative relationship with GDP, with a coefficient of –0.28 ($p < 0.01$). These results confirm that healthier populations contribute more productively to economic development. The study underscores the vital role of health as a component of human capital and highlights the macroeconomic benefits of investing in healthcare. Policy implications include the need for increased and efficient health spending, improved access to healthcare services, and regionally coordinated efforts to reduce health disparities. Strengthening the healthcare sector in South Asia is not only a social imperative but also an economic strategy for sustainable development and long-term growth.

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## INTRODUCTION

Human capital is an essential aspect of the process of sustainable economic development. According to general literature, human capital encompasses education, training programs, migration opportunities, and other investment opportunities aimed at increasing employee productivity. There was agreement that human capital development is essential in achieving nations' structural and economic growth (Alwago, 2023). The acquisition of human capital fosters economic advancement. The human capital hypothesis asserts that individuals' investments in human capital augment their productivity across both market and non-market sectors. Health is a factor in human capital Theory (Esen et al., 2022). It is an essential part of the economy and the wellbeing of the people. Investments in the healthcare sector have been shown to have a significant positive impact on the economy. According to this, funding the healthcare system improves public health, generates employment opportunities, promotes social and political stability, and ultimately aids in the expansion and advancement of the economy as a whole (Si et al., 2021).

Government spending on health in developing countries, especially those in South Asia, remains underrepresented despite massive investments in the health sector. This is because there aren't enough resources. While the South Asian economy experienced robust GDP growth between 2020 and 2024, with rates ranging from 6.2 percent to 7.5 percent, recent forecasts suggest a softening in growth for 2025. The health-led growth hypothesis considers health as a form of capital. The health-led growth hypothesis emphasized that health investment causes an increase in productivity, and thus in income per capita and economic growth (Esen et al., 2022). One of the most significant factors contributing to the expansion of a creative, knowledge-based, and growing economy is the amount spent on healthcare. In accordance with the findings of Kousar et al. 2020 and Ridhwan et al. 2022, the state of health exerts a significant and positive influence on the growth of the economy.

Improving public health is essential for building an innovative, knowledge-based, and sustainable economy. A healthy population strengthens human capital, boosts labor productivity, and accelerates economic growth. Better health enables individuals to access higher-paying jobs, enhances educational attainment, and improves quality of life. As incomes rise, demand for healthcare services increases, and greater investment in health is expected to further improve overall well-being. This, in turn, fosters economic progress and raises living standards. South Asia, home to about a quarter of the world's population, has seen rapid economic growth in recent decades, driven by globalization, liberalization, and macroeconomic reforms (Alvarado et al., 2023).

Health influences the economy through four key channels: (i) healthier workers are more productive and tend to earn higher incomes, (ii) good health extends working life and reduces sick leave, (iii) healthy individuals are more inclined to invest in education and skills, and (iv) longer life expectancy encourages greater savings and investment (Odhiambo, 2021). In this way, health is central to sustainable development and economic security, empowering individuals and strengthening communities.

Despite improvements in health indicators, South Asian countries still display significant differences in healthcare investment and the resulting economic benefits. Understanding whether increased health spending leads to sustained economic growth is vital for shaping effective public policies. This study, therefore, aims to: (1) examine trends in healthcare spending and economic growth in South Asia, and (2) empirically assess the impact of health expenditures on economic growth in the region. The outcomes are intended to guide more efficient health financing strategies and support long-term, inclusive economic development.

## MATERIALS AND METHODS

To gather valid results, one should select the variables that will be applied and apply a sensible method. The methodology will also incorporate an appropriate approach to use in estimating the econometric model, bearing in mind the purposes of the research study being undertaken. It is the most critical and delicate element in the accomplishment of any research project. In this section, the heading of data sources describes the data resources it acquired to undertake this research investigation. The following section (Model Specification) describes the model specification used in this investigation. The descriptions of variables presented in the section have illuminated what the measuring scale of the variables under consideration is and how they have been used in the estimating model; also, the methodology and estimation techniques applied to estimate the findings have been addressed.

### Data Sources

The purpose of this research was to investigate the economic growth of Pakistan in relation to the consequences of spending on healthcare. A reasonable achievement of the research's aim and goal is attained through the utilization of secondary sources of data in the construction of the study. All variables have been taken from a panel dataset that encompasses six South Asian nations, namely Pakistan, India, Bangladesh, Nepal, Bhutan, and Sri Lanka, throughout the period 2000–2019. The availability of the required data determined the selection of the nations.

An assortment of data sources was used to collect all the variable data. These include the World Bank (WB) and the World Development Indicator (WDI), in addition to the economic surveys obtained from the selected nations. In this study, the variables Gross Domestic Product (GDP), Health Care Expenditure (HCE), Gross Fixed Capital Formation (GFCF), Life Expectancy Rate (LER), and Infant Mortality Rate (IMR) have been included and used for analysis.

### Model Specification

Health expenditure is a major actor in the economic improvement of the world. Based on this, spending on health care may have a functional relationship with economic growth (Sirag et al., 2013). In this paper, Gross Domestic Product (GDP) was the indicator of economic growth used, and it is measured in terms of the percentage yearly growth rate. This study used GDP as the dependent variable. It included spending on healthcare, life expectancy at birth, infant mortality rate per 1,000 live births, and gross fixed capital formation as independent variables. Variables are all percentages of growth per year. The values of the six South Asian countries' variables during 2000-2019 have been utilized and recoded into the log form.

The following model has been specified in an attempt to evaluate the impact of health care expenditure on economic growth in South Asian countries.

$$GDP = f(HEexp + LER + MR + GCF) \quad (1)$$

$$GDP = \beta_o + \beta_1 HCE + \beta_2 GFCF + \beta_3 LER + \beta_4 MR + \mu_1 \quad (2)$$

Whereas,

GDP = Gross Domestic Product Annual Percentage Growth
HEexp = Government Health Expenditure Percentage to GDP
LER = Life Expectancy Rate at Birth Total
MR = Mortality Rate Infant (per 1000 lives)
GCF = Gross Capital Formation in Percentage
μt = Error Term
α = Intercept
$\beta_1, \beta_2, \beta_3, \beta_4$ = Slope Coefficients

In the above model, GDP is treated as the dependent variable. At the same time, health spending, life expectancy at birth, infant mortality rate, and gross fixed capital formation are used as the independent variables.

The logarithm form of it is as follows:

$$lnGDP = \beta_0 + \beta_1 lnHEexp_t + \beta_2 lnLER_t + \beta_3 lnMR_t + \beta_4 lnGFCF_t + \mu t \quad (3)$$

whereas,

lnGDP = Natural log of Gross Domestic Product Annual Percentage Growth
lnHEexp = Natural log of Government Health Expenditure Percentage to GDP
lnLER = Natural log of Life Expectancy Rate at Birth Total
lnMR = Natural log of Mortality Rate Infant (per 1000 lives)
lnGCF = Natural log of Gross Capital Formation Annual Growth
μt = Error Term

In the above model, $\beta_0$ denotes the constant term, while $\beta_1$ to $\beta_4$ represent the coefficients of the respective independent variables and the effect.

### Description of Variables

Gross Domestic Product

Gross Domestic Product is a significant indicator of the total economic growth of a nation. GDP is the broadest quantitative measure of a country's total economic activity. Further explanation, GDP is defined as the value of all final goods and services produced in a country in a specific time period. GDP is used in this paper as a proxy of economic growth and as a dependent variable. Most studies have used it as a proxy of economic growth (Afridi, 2016; Afzal, 2010; Rehman et al., 2018; Maitra, 2018; Azam et al., 2109).

***Expenditure on Health Care***

There are two types of health expenditures: private health spending and public health spending. Money spent on health out of pocket is known as private health spending. The government health spending consists of budgets, international aid, and social health insurance funds. This study used healthcare expenditure as the explanatory variable. Most studies have been used in different studies (Javed et al., 2013; Ogunleye et al., 2017; Rehman et al., 2018).

***Gross Fixed Capital Formation***

Basically, gross fixed capital formation is defined as the net investment in fixed capital. In this study, gross fixed capital formation is used as the explanatory variable, and the data have been taken in annual growth (Iqbal et al., 2013; Shahzad, 2107). This variable has also been used as an explanatory variable.

***Life Expectancy Rate at Birth Total***

Life expectancy is an essential measure of health and is also an important factor in a country's economic growth. It shows how many years a person is likely to live on average. Hena et al. (2019) discovered that a one percent rise in life expectancy results in a

13.39 percent increase in economic growth. Similarly, Rehman et al. (2018) examined the impact of life expectancy on economic development, finding a positive effect. This study utilizes life expectancy as one of the independent variables.

### *Infant Mortality Rate*

Infant mortality is also seen as a significant result of health spending and is very important for a country's economic growth. This study utilizes the Infant Mortality Rate (per 1,000 live births). Numerous studies have used this variable as a surrogate for health outcomes (Rehman et al., 2018).

### Hypothesis Testing

$H_0$ = Health care spending doesn't have a statistically significant effect on the economic growth of South Asian countries.

$H_1$ = The amount of money spent on health care has a significant effect on the economic growth of South Asian countries.

### Diagnostic Tests

Most of the time series and panel data at this level are not stationary. If a method is used with non-stationary data, the results may lead to incorrect conclusions. The first step in the modeling process is to test the order in which the variables are combined. This is done to ensure that such problems don't occur and that the results are accurate. The second step is to do a co-integration test to see if there is a long-term relationship between the variables. This is achieved through the application of limits testing for co-integration within the. It is essential to ensure the model meets the intended specifications, so diagnostic checks are done using the ARDL method. Akaike Information Criterion (AIC) is used to find the best lag duration. To deal with heteroscedasticity and make estimation more accurate in panel data analysis, all variables are written in natural logarithms.

### *Unit Root Test*

Linked the econometrics, establishing estimation methodologies that depend on the presumption that the mean and variance of the time series remain constant over time. Be that as it may, the methods and differences of numerous macroeconomic factors are not consistent and change over time. These factors are called non-stationary factors or unit roots. When the established estimation strategy, OLS, was applied to the variables, it yielded false estimates. Some unit root tests, for example, the Augmented Dickey Fuller test, KPSS, and Phillips Perron test, were used to investigate the fundamental properties of units of time arrangement factors. This study applied the Augmented Dickey Fuller test and the Phillips Perron test to examine the order of integration of the variables included in the model.

### Augmented Dickey Fuller Test (ADF)

In 1979, Dickey and Fuller developed the Augmented Dickey-Fuller (ADF) unit root test to address non-stationarity in time series data. This enhancement was designed to overcome the problem of autocorrelation that can occur when lagged terms of the dependent variable are included among the independent variables. The core idea of the Dickey-Fuller approach is that testing for non-stationarity is equivalent to testing for the presence of a unit root. The augmented version improves the original test by incorporating additional lagged terms of the dependent variable, effectively reducing autocorrelation. The ADF test provides three different model specifications for detecting unit roots.

$$\Delta X_t = \gamma X_{t-1} + \sum \beta_1 X_{t-1} + \varepsilon_t \quad (4)$$

$$\Delta X_t = \alpha_0 + \gamma X_{t-1} + \sum \beta_1 X_{t-1} + \varepsilon_t \quad (5)$$

$$\Delta X_t = \alpha_0 + \gamma X_{t-1} + \alpha_2 t + \sum \beta_1 X_{t-1} + \varepsilon_t \quad (6)$$

The above equations give three possibilities. Equation 1 reveals the possibility when the data is without an intercept and trend. Equation 2 shows the potential when the data has been intercepted. In this particular investigation, the McKinnon (1991) table was utilized to determine whether or not the null hypothesis should be accepted.

### Phillips Perron Test (PP)

A generalization of the ADF test procedure was developed by Phillips and Perron (1988) that permits for just mild assumptions regarding the distribution of error. To analyze the stationarity of data series, the current study employed the PP and ADF unit root tests. The following equation gives the possible form of the Phillips-Perron test;

$$\Delta X_t = \alpha_0 + \gamma X_{t-1} + \varepsilon_t \quad (7)$$

### ARDL Model Specification

Investigating the presence of an ARDL, which stands for autoregressive distributed lag, is a way to test how the variables are related over time. In the ARDL model, both dependent and independent variables can be included with appropriate lag structures.

The general ARDL equation is below:

$$\Delta ln(GDP) = \gamma 0 + \gamma 1 \ln(GDP) + \gamma 2 \ln(GHE) + \gamma 3 \ln(GCF) + \gamma 54 + \gamma\ 5\ln(MR) + \sum\gamma 6\Delta \ln(\mathrm{GDP}) + \sum\gamma 7\Delta \ln(\mathrm{GHE}) + \sum\gamma 8\Delta \ln(\mathrm{GCF}) + \ln \sum\gamma 9\Delta \ln(\mathrm{LER}) + \sum\gamma 10\Delta \ln(\mathrm{MR}) + \mu \quad (8)$$

The equation given above for the ARDL model illustrates the long-term and short-term connections between dependent and independent variables. γ0 is constant term whereas γ1, γ2, γ3, γ4, γ5 are the long-run coefficients and γ6, γ7, γ8, γ9, γ10 are the short run coefficients. But μt encompasses disturbance. A term that includes all the variables that aren't in the equation, and the symbol Δ stands for the first difference.

### Bound Test for Co-Integration

The long-run relationship between variables is presented by the bound test for co-integration with the help of the Wald test.

The Null Hypothesis is given below as:

$H_0: \gamma_6 = \gamma_7 = \gamma_8 = \gamma_9 = \gamma_{10} = 0$

And the Alternative Hypothesis is:

$H_1: \gamma_6 = \gamma_7 = \gamma_8 = \gamma_9 = \gamma_{10} \neq 0$

The null hypothesis ($H_0$) states that no short-term co-integration or relationship exists, meaning all coefficients are equal to zero. In contrast, the alternative hypothesis ($H_1$) suggests the presence of a long-term association when at least one coefficient differs from zero. The F-statistic is used to evaluate these hypotheses by comparing the calculated value with critical values provided by Pesaran et al. (1996). If the F-statistic exceeds the upper bound, $H_0$ is rejected, confirming a long-term co-integration. If it falls below the lower bound, $H_0$ is accepted, indicating no such relationship. When the F-statistic lies between the lower and upper bounds, no definitive conclusion can be drawn.

$$\ln GDP_t = \beta_0 + \sum \beta_{1i} \ln\ (GDP)_{t-1} + \sum \beta_{2i} \ln\ (GHE)_{t-1} + \sum B_{3i} \ln\ (GCF)_{t-i} + \sum \beta_{4i} \ln\ (LER)_{t-i} + \sum \beta_{5i} \ln\ (MR)_{t-1} + \mu_t$$

## RESULTS AND DISCUSSIONS

The purpose of this research is to investigate the impact of health care expenditure on the economic growth of South Asian countries. To empirically evaluate the relationship among health care expenditure, gross fixed capital formation, life expectancy rate, infant mortality rate, and economic growth in South Asian countries from 2000-2019, we employed trend analysis. To illustrate the trend of analysis over time, a graphical representation of the variables is provided in the first section. In the second section, statistical results of the unit root and fixed effect model of panel data have been discussed. Figures had been used to describe the yearly based trend analysis of government health care expenditure percentage to GDP, gross capital formation, life expectancy rate, and infant mortality rate.

**Trend Analysis**

For representing the trends of the concerned data over a time period, descriptive statistics is one of the well-known and straightforward techniques. For describing the elementary features of the study data set, a source is used. It provides a summary of trends in variables based on their analytical trends, which can be negative, positive, or constant, as defined in graphical forms. To analyze the general trend of the time series over a period of time, conduct a fundamental graphical analysis. The data for all variables are in per capita US Dollars.

Figure 1 illustrates the annual GDP growth trend in percentage for all selected Asian countries over the period from 2000 to 2019. In the above graphs, the time series (GDP) is plotted on the y-axis, and the time period is plotted on the X-Axis. Overall, the fluctuating trend is shown by the graph. Bangladesh's GDP is increasing compared to other countries, whereas Nepal's GDP is decreasing over time. The graph of Pakistan's GDP fluctuations shows a notable decrease in growth in the middle, followed by a very low stage. However, GDP growth increased for several years before declining again in later years. Sri Lanka's GDP trend has shown both increasing and decreasing trends, but it is comparatively better than that of other countries, such as Pakistan and Nepal. One thing remains the same in the graphs of all countries: GDP growth declined in the latter years, such as 2018 and 2019, except for Bangladesh.

Figure 2 illustrates the trend in healthcare spending as a percentage of GDP over time, with the trend line highlighting fluctuations in healthcare expenditures across all selected countries. On the Y-axis, health expenditure is plotted, and on the X-axis, the time period is plotted. Overall, the graph of Nepal shows a linear trend, indicating that healthcare expenditure in Nepal is increasing over time. Although Nepal's graph has shown fluctuations, the health expenditure has increased in the early years, starting from 2008. The figure shows that Bangladesh's health spending was higher in the early years, but it decreased from 2008 to 2017, only to increase sharply again in 2019. The health spending trends of Pakistan and India are showing almost the same trend. Health spending decreased from 2000 to 2010, following a period of increasing trends. Health spending is decreasing in Bhutan and Sri Lanka. The graphs of Bhutan and Sri Lanka show that both countries spend very low amounts on the health sector relative to other countries. Overall, India, Pakistan, and the South Asian region spend more on the health sector compared to Bhutan, Sri Lanka, and Bangladesh.


Figure 1. Trend of GDP annual growth in percentage of selected countries from 2000-2019.

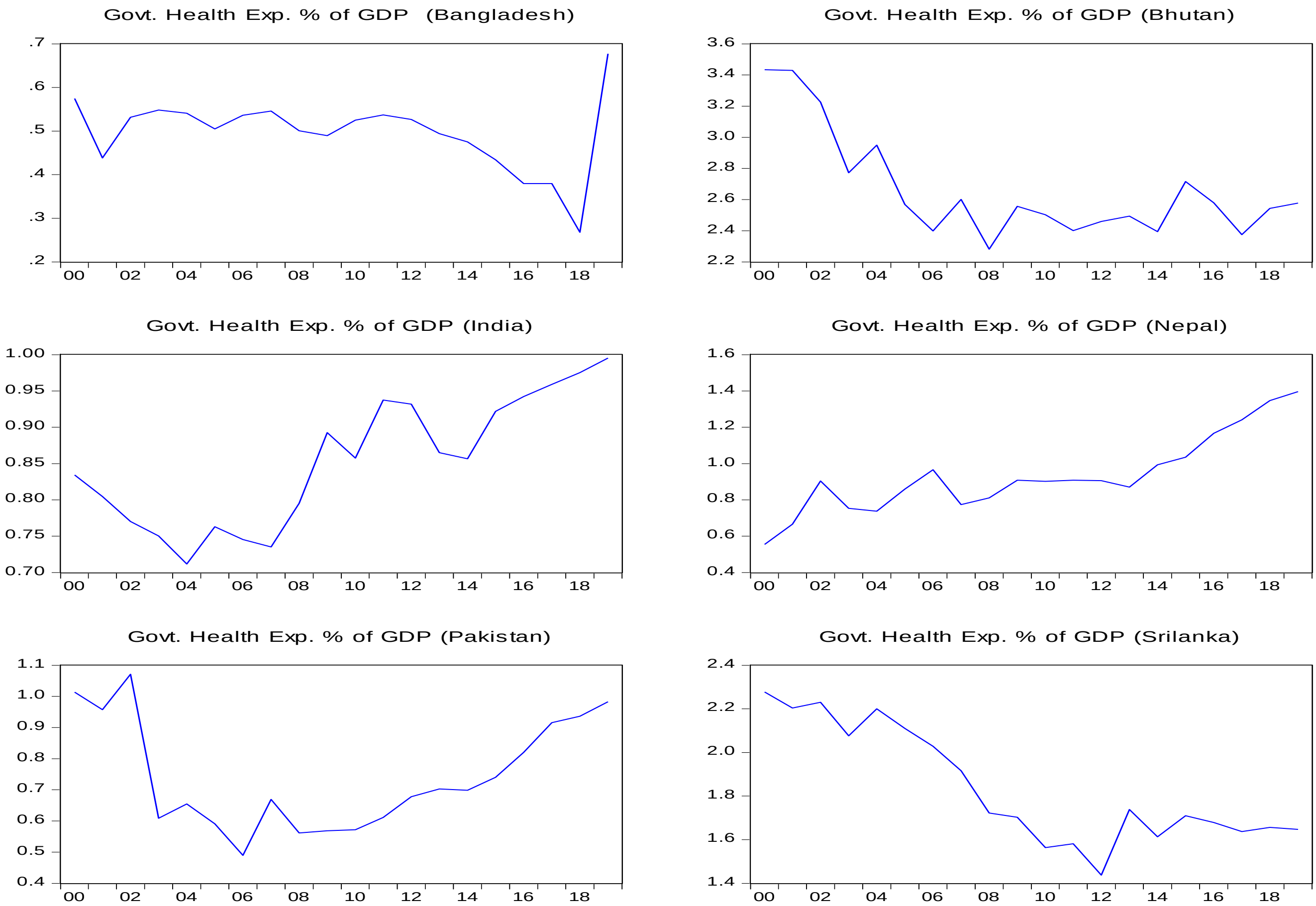


Figure 2. Trend of Govt. Health expenditure % of GDP of selected countries from 2000-2019.

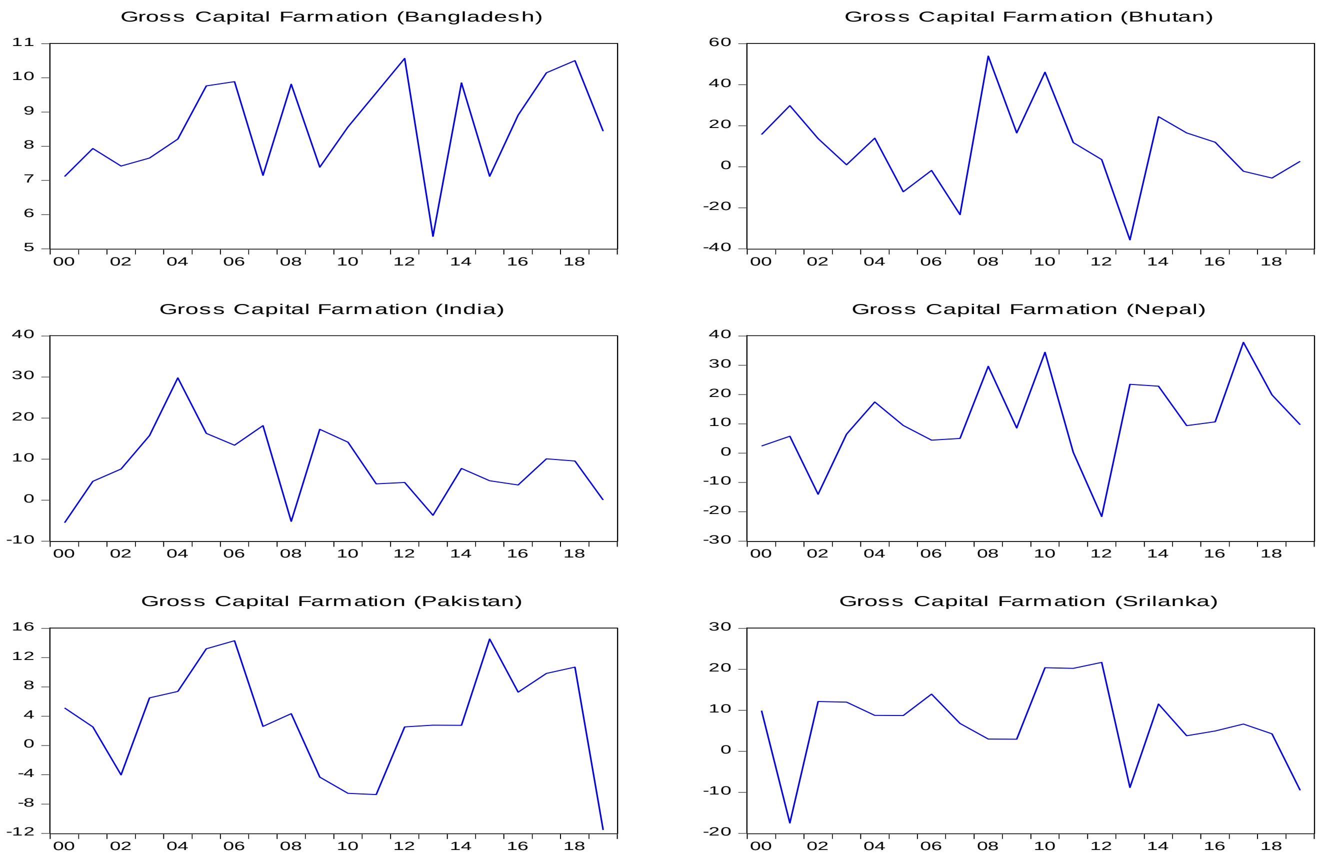


Figure 3. Trend of gross capital formation annual growth percentage of South Asia from 2000-2019.

Figure 3, comprising six graphs, illustrates the trend of gross capital formation over time in the South Asia region. In the graphs, the Y-axis shows the time series of gross capital formation, and the X-axis shows the time period. The trend of gross capital formation is nearly identical across all selected countries. The graphs above illustrate the fluctuations in the data. Gross capital formation in Bangladesh has experienced significant volatility, but overall, it is increasing. The capital formation of Bhutan and Nepal is relatively low compared to other countries. The gross capital formation in Pakistan decreased in 2002, increased until 2006, then decreased again until 2012, increased, but in 2019, it declined sharply. One thing is the same in all selected countries: the gross capital formation decreased in 2019.

Figure 4 illustrates the trend in life expectancy rates for the South Asia region over time, with a positive trend indicated by the line. The life expectancy is the primary outcome of health spending. However, on the Y-axis, the total life expectancy at birth is plotted, and on the X-axis, the time period is represented. The positive trend in the above panel indicates that life expectancy is increasing over time. The trend in life expectancy rates is the same in all selected countries. So, it can be concluded that the life expectancy rate is in better condition.

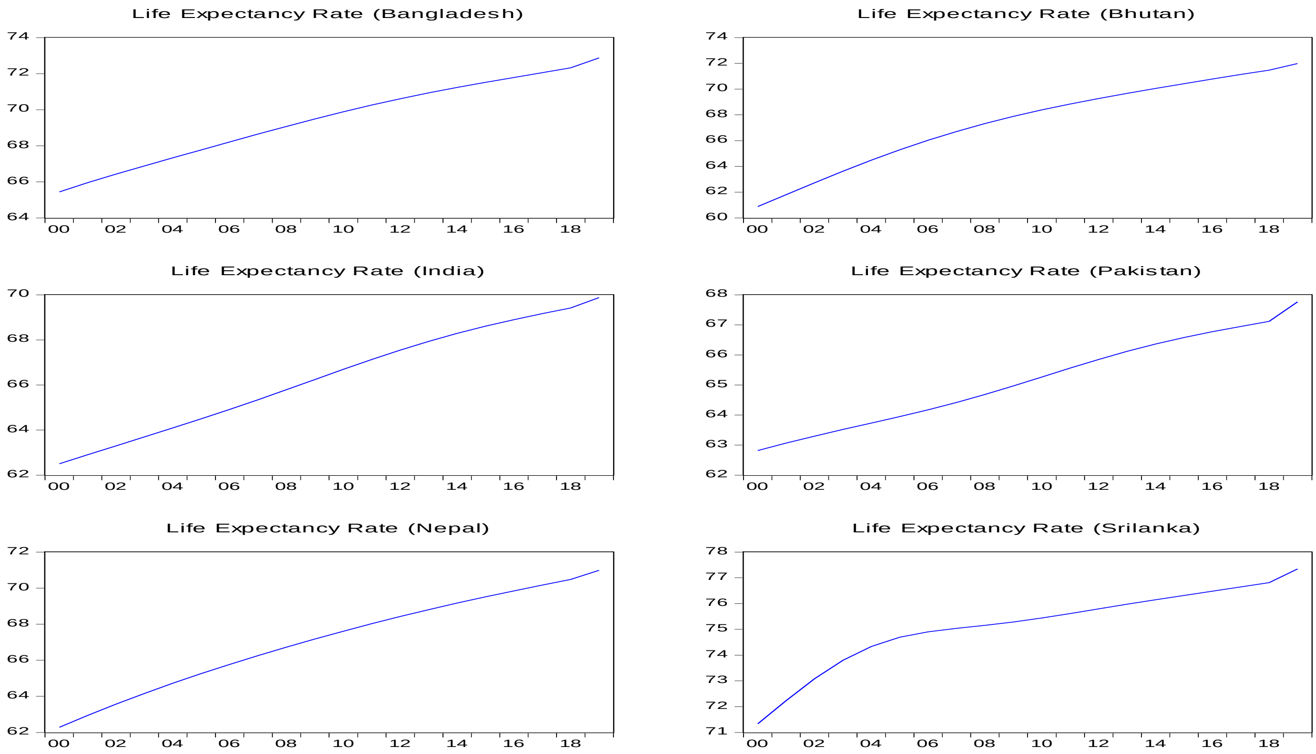


Figure 4. Trend of life expectancy rate in South Asia from 2000-2019.

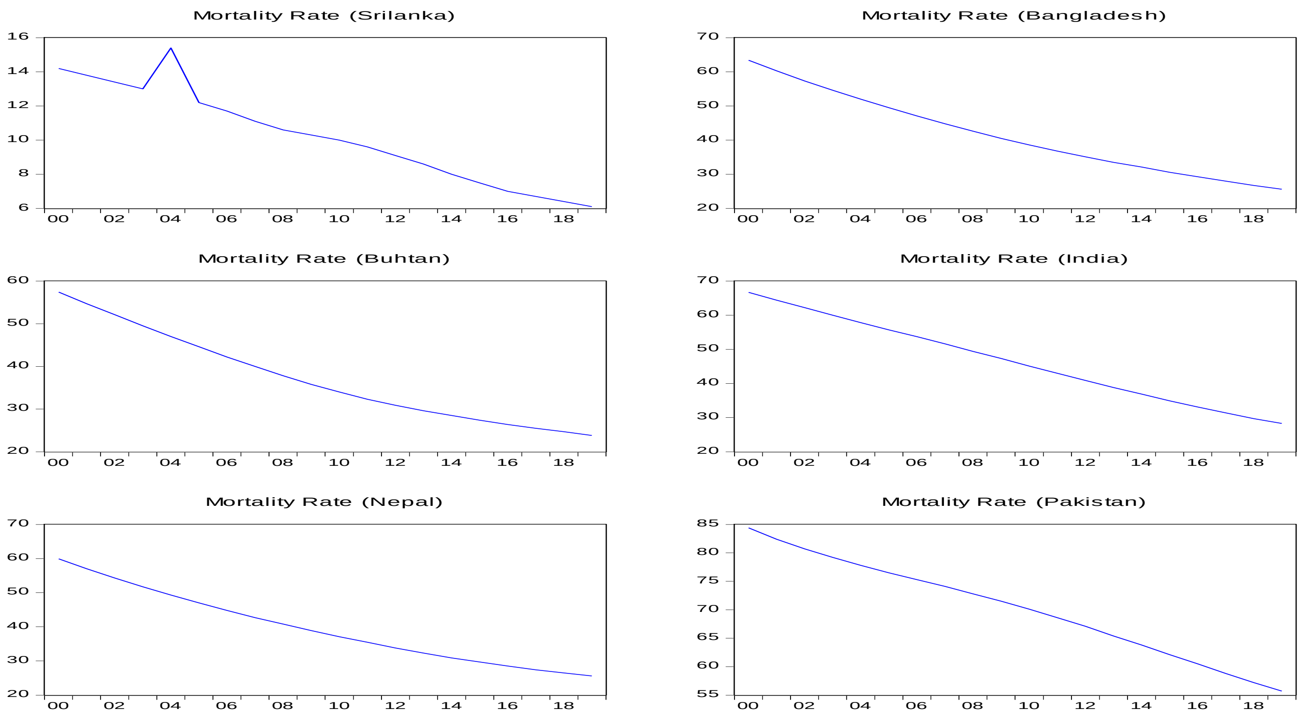


Figure 5. Trend of Infant Mortality Rate (per 1000 lives) of South Asia from 2000-2019.

Figure 5 shows the trend of the Infant Mortality rate per 1000 lives over the period from 2000 to 2019. In figures, the time series (Infant Mortality Rate (per 1000 lives)) is taken on the Y-axis and the time it took on the X-axis. The above graphs show a negative linear trend in the infant mortality rate in the South Asia region, indicating a decrease over time. In the above panel, the same trend is evident across all selected countries. However, in Sri Lanka, the infant mortality rate increased from 2002 to 2004, but after that, it started to decrease. Although the infant mortality rate trend is negative in all selected countries, the starting points differ, indicating that the rate is better in some countries than others. Sri Lanka's starting point is relatively better than that of other countries. However, the child mortality rate in Pakistan is still very high compared to other countries. The infant mortality rate in Sri Lanka is significantly better compared to other selected countries.

**Empirical Analysis**

The empirical study is the significant and primary component of the research, conducted to establish the quantitative correlation between the variables employed in this research using proper econometric models. In this research, we test the role of health care spending and two health outcomes in the economic growth of South Asian nations.

Descriptive measures report the pattern of the behavior and mean values of the variables over various time periods. Mean reports about the mean value of variables and standard deviation indicate the extent to which the values diverge from the mean. The minimum value of the standard deviation suggests the stable behavior of the variable. Table 1 presents descriptive statistics results, including gross domestic product, health expenditure, gross capital formation, infant mortality rate, and life expectancy rate.

Table 1. Results of descriptive statistics.

| Variables | GDP | GHE%GDP | GCFLERMR | GCFLERMR | GCFLERMR |
|---|---|---|---|---|---|
| Mean | 5.610682 | 1.254027 | 7.915392 | 68.43015 | 40.88250 |
| Median | 5.674149 | 0.912100 | 7.814172 | 67.90650 | 39.45000 |
| Maximum | 18.36085 | 3.433771 | 53.98100 | 77.34500 | 84.40000 |
| Minimum | -1.545408 | 0.267735 | -35.69141 | 60.88400 | 6.100000 |
| Std. Dev. | 2.438823 | 0.787476 | 12.11909 | 4.008532 | 20.14406 |
| Skewness | 0.938413 | 0.986157 | 0.199301 | 0.450120 | 0.099142 |
| Kurtosis | 8.586569 | 2.804862 | 6.163040 | 2.391271 | 2.246676 |
| Jarque-Bera | 173.6611 | 19.64049 | 50.81852 | 5.904917 | 3.034071 |
| Probability | 0.000000 | 0.000054 | 0.000000 | 0.052211 | 0.219361 |
| Sum | 673.2819 | 150.4833 | 949.8470 | 8211.618 | 4905.900 |
| Sum Sq. Dev. | 707.7950 | 73.79407 | 17477.81 | 1912.131 | 48288.21 |
| Observations | 120 | 120 | 120 | 120 | 120 |

Table 2. ADF outcomes at level.

| ADF test statistics for Gross Domestic Product | | T statistics | Probability | Decision |
|---|---|---|---|---|
| | | 28.19 | | |
| Test critical values at | One percent level | -3.486 | | |
| | Five percent level | -2.886 | | |
| | Ten percent level | -2.579 | 0.0052 | Stationary |
| ADF test statistics for Gross Capital Formation | | T statistics | Probability | Decision |
| | | 30.6833 | | |
| Test critical values at | One percent level | -3.486 | | |
| | Five percent level | -2.885 | 0.0028 | Stationary |
| | Ten percent level | -2.579 | | |
| ADF test statistics for Health Expenditure | | T statistics | Probability | Decision |
| | | -2.371 | | |
| Test critical values at | One percent level | -3.486 | | |
| | Five percent level | -2.886 | 0.1519 | Non-Stationary |
| | Ten percent level | -2.579 | | |
| ADF test statistics for Life Expectancy Rate | | T statistics | Probability | Decision |
| | | -2.626 | | |
| Test critical values at | One percent level | -3.486 | | |
| | Five percent level | -2.886 | 0.0904 | Non-Stationary |
| | Ten percent level | -2.579 | | |
| ADF test statistics for Infant Mortality Rate | | T statistics | | |
| | | -2.551 | | |
| Test critical values at | One percent level | -3.486 | 0.1063 | Non-Stationary |
| | Five percent level | -2.886 | | |
| | Ten percent level | -2.579 | | |

The findings indicate that the mean return of GDP growth is 5.6106 percent, and at a level of standard deviation 2.4388 percent, and the mean return of government health expenditure is 1.254 percent at a given level of S.D. of 0.7875 percent. Gross capital formation has a 7.9154 percent mean return at a S.D. of 12.119 percent. The mean return of the life expectancy rate is 68.4301 percent, which is the highest among the other variables at a S.D of 4.0085 percent, and the infant mortality rate possesses a 40.8825 percent mean return at a S.D of 20.1441 percent. Therefore, it is inferred that the life expectancy rate possesses a higher mean return compared to other variables. The lowest value of the rate of life expectancy is 60.884, and the highest is 77.345.

Table 2 presents the outcomes of the unit test used in conjunction with the PP and ADF tests. The stationary outcomes of the ADF test at the level are presented in the table below. The ADF results for Gross Domestic Product revealed that the value of the t-statistics is superior to the CV at one percent, five percent, and ten percent levels, and the PV is less than 0.05. Therefore, the $H_0$ is putative and determined that GDP has no unit root, and at the level, the data is stationary. The ADF value for Gross Capital Formation is higher than CV at 1%, 5%, and 10% levels, respectively, and the probability value is lower than 0.05%. Therefore, the $H_0$ is rejected, indicating that the decision variable is a unit root, and the level data is non-stationary. Also, the t-statistics of health expenditure are smaller than CV at one percent, five percent, and ten percent levels, respectively, and the probability value is also larger than 0.05. Therefore, the $H_0$ is accepted, concluding that the level of health expenditure exhibits a unit root and the data are non-stationary at this level. ADF results for the life expectancy rate have shown that the value of the t-statistic is less than the CV level, and the possibility value is also higher than 0.05. Therefore, the decision is to accept the null hypothesis, concluding that the data do not exhibit stationarity at the specified level, and the variable in question has a unit root. The t-statistic is also lower than the CV at all levels, and the P value is higher than 0.05. The same goes for the variable for death rate. Because the data are non-stationary, it has been concluded that this is the case.

Table 3. The findings show that all variables become stationary after first differencing. For gross domestic product (GDP), the t-statistic exceeds the critical values at the 1%, 5%, and 10% significance levels, while the probability value is below the 0.05 threshold. A similar outcome is observed for gross fixed capital formation (GFCF), where the t-statistic is greater than the critical values at all significance levels and the probability value is below 0.05, indicating stationarity. Health expenditure also exhibits the same pattern, with the t-statistic surpassing the value of 0.05. Life expectancy results align with these findings, as the t-statistic is higher at given levels, and the probability value is below the threshold, showing that the data is stationary. Lastly, the infant mortality rate follows the same trend, with the test statistics indicating no unit root and confirming stationarity after first differencing.

Table 3. ADF outcomes at first difference.

| ADF test statistics for Gross Domestic Product | | T statistics | Probability | Decision |
|---|---|---|---|---|
| | | -9.769 | | |
| Test critical values at | One percent level | -3.486 | | |
| | Five percent level | -2.886 | 0.0000 | Stationary |
| | Ten percent level | -2.579 | | |
| ADF test statistics for Gross Capital Formation | | T statistics | Probability | Decision |
| | | -10.397 | | |
| Test critical values at | One percent level | -3.486 | | |
| | Five percent level | -2.886 | 0.0000 | Stationary |
| | Ten percent level | -2.579 | | |
| ADF test statistics for Health Expenditure | | T statistics | Probability | Decision |
| | | -10.765 | | |
| Test critical values at | One percent level | -3.486 | | |
| | Five percent level | -2.886 | | |
| | Ten percent level | -2.579 | 0.0000 | Stationary |
| ADF test statistics for Life Expectancy Rate | | T statistics | Probability | Decision |
| | | -11.073 | | |
| Test critical values at | One percent level | -3.486 | | |
| | Five percent level | -2.886 | 0.0000 | Stationary |
| | Ten percent level | -2.579 | | |
| ADF test statistics for Infant Mortality Rate | | T statistics | Probability | Decision |
| | | -11.028 | | |
| Test critical values at | One percent level | -3.486 | | |
| | Five percent level | -2.886 | 0.0000 | Stationary |
| | Ten percent level | -2.579 | | |

Table 4. Phillips-Perron calculations at level.

| PP test statistics for Gross Domestic Product | | T statistics | Probability | Decision |
|---|---|---|---|---|
| | | 39.2576 | | |
| Test critical values at | 1% level | -3.486 | 0.0001 | Stationary |
| | 5 % level | -2.886 | | |

| | | | | |
|---|---|---|---|---|
| | 10 % level | -2.579 | | |
| PP test statistics for Gross Capital Formation | | T statistics | Probability | Decision |
| | | 24.7552 | | |
| Test critical values at | 1 % level | -3.286 | 0.0000 | Stationary |
| | 5 % level | -2.886 | | |
| | 10 % level | -2.579 | | |
| PP test statistics for Health Expenditure | | T statistics | Probability | Decision |
| | | -2.522 | | |
| Test critical values at | 1 % level | -3.286 | 0.1126 | Non-Stationary |
| | 5 % level | -2.886 | | |
| | 10 %level | -2.579 | | |
| PP test statistics for Life Expectancy Rate | | T statistics | Probability | Decision |
| | | -2.648 | | |
| Test critical values at | 1 % level | -3.286 | 0.0863 | Non-Stationary |
| | 5 % level | -2.886 | | |
| | 10 %level | -2.579 | | |
| PP test statistics for Infant Mortality Rate | | T statistics | Probability | Decision |
| | | -2.552 | | |
| Test critical values at | 1%level | -3.286 | 0.1059 | Non-Stationary |
| | 5%level | -2.886 | | |
| | 10 % level | -2.579 | | |

Table 4 shows the results of the Phillips-Perron test at the level. The stationary results of variables at the level are given in the following table. As a result, the ($H_0$) is not accepted, indicating that the GDP does not have a unit root at the level, and the data is not stationary. The results of the PP for gross capital formation indicate that the value of the t-statistic is higher than the CV at 1, 5, and 10%, and that the possibility value is higher than 0.05. In a similar vein, the results of the PP for health care expenditures suggest that the t-statistic value is low in comparison to the CV at 1, 5%, and ten percent levels, respectively, and also the possibility value is high from 0.05. Thus, the null hypothesis was held, concluding that health expenditure possesses a unit root and the data is not stationary at the level. The PP value for the rate of life expectancy indicates that the t-statistic value is smaller than the CV at one percent, five percent.

Additionally, the level of ten percent and the probability value are both greater than 0.05. The results indicate that the null hypothesis ($H_0$) was accepted and the alternative hypothesis ($H_1$) was rejected for life expectancy, suggesting the presence of a unit root and stationarity at the level form. For the infant mortality rate, the Phillips-Perron (PP) test shows that the t-statistic is lower than the critical values at the 1%, 5%, and 10% significance levels, while the probability value exceeds 0.05. This outcome supports acceptance of the null hypothesis, confirming that the variable possesses a unit root and is stationary at the level.

The Phillips-Perron (PP) stationarity results at the first difference are summarized in Table 5. For GDP, the PP test shows that the t-statistic exceeds the critical values at the 1%, 5%, and 10% significance levels, with a probability value below 0.05. This leads to the rejection of the null hypothesis and acceptance of the alternative, indicating that GDP is free from a unit root and stationary at the first difference. Similarly, results for Gross Fixed Capital Formation reveal a t-statistic greater than the critical values at all three significance levels and a probability value below 0.05, confirming stationarity at the first difference. Health care expenditure results also show t-statistics above the critical thresholds and probability values under 0.05, supporting the conclusion that the data is stationary at the first difference. For Life Expectancy Rate, the PP test yields t-statistics higher than the critical values with probability values below 0.05, indicating no unit root and stationarity at the first difference. The same applies to Infant Mortality Rate, where the t-statistic is higher than the critical values and the probability value is under 0.05, leading to rejection of the null hypothesis and confirming stationarity at the first difference.

Table 5. Phillips Perron outcomes at 1st difference.

| PP test statistics for Gross Domestic Product | | T statistics | Probability | Decision |
|---|---|---|---|---|
| | | -9.769 | | |
| Test critical values at (level) | 1% | -3.286 | 0.0000 | Stationary |
| | 5 % | -2.886 | | |
| | 10 % | -2.579 | | |
| PP test statistics for Gross Capital Formation | | T statistics | Probability | Decision |
| | | -3.788 | | |
| Test critical values at | 1 % | -3.286 | | |
| (level) | 5 % | -2.886 | 0.0000 | Stationary |
| | 10 % | -2.579 | | |
| PP test statistics for Health Care Expenditure | | T statistics | Probability | Decision |
| | | -10.765 | | |
| Test critical values at (level) | 1 % | -3.487 | 0.0000 | Stationary |
| | 5 % | -2.886 | | |

| | | | | |
|---|---|---|---|---|
| | 10 % | -2.579 | | |
| PP test statistics for Life Expectancy Rate | | T statistics | Probability | Decision |
| | | -11.092 | | |
| Test critical values at (level) | 1 % | -3.487 | | |
| | 5 % | -2.886 | 0.0000 | Stationary |
| | 10 % | -2.579 | | |
| PP test statistics for Infant Mortality Rate | | T statistics | Probability | Decision |
| | | -11.040 | | |
| Test critical values at (level) | 1% | -3.487 | 0.0000 | Stationary |
| | 5% | -2.886 | | |
| | 10 % | -2.579 | | |

Table 6a presents the summary results of the Augmented Dickey Fuller test and Phillips Perron tests of unit root at level and 1st difference. The results of both unit root tests indicate that the data is non-stationary at levels but stationary at the first difference, with probability values of one, five, and ten percent, respectively. Notably, the probability values of both tests are greater than 0.05 in non-stationary data, whereas they are less than 0.05 percent in stationary data. Table 6b shows these critical values are presented for both the level and first difference tests, and they are presented across three different significance levels: 1%, 5%, and 10%. All of these crucial numbers are the same for every single exam and every single test level: –3.486 is the essential value at the 1% level, –2.886 is at 5% level, and –2.579 is the critical value at the 10% level. For the purpose of determining whether or not the non-stationarity null hypothesis of a unit root can be rejected, these benchmarks are an essential tool.

Table 7 presents the results of the ARDL model used in this study to assess both the short-run and long-run relationships between government health expenditure (GHE) and economic growth across selected South Asian countries—Pakistan, India, Bangladesh, Nepal, Bhutan, and Sri Lanka—for the period 2000–2019. The short-run estimates indicate a negative association between GHE and GDP, with a one percent increase in health expenditure corresponding to a 2.0608 percent decrease in GDP. This aligns with previous studies (Dreger and Reimers, 2005; Akram et al., 2008; Bukenya, 2009; Maitra, 2010; Asghar et al., 2012; Khattak and Khan, 2012; Ye and Zhang, 2018) that also found no significant positive link in the short term for South Asia, attributing the result to factors such as corruption and inadequate investment in the health sector. Similar findings have been reported in other regions, such as Iran (Khan et al., 2016) and in broader cross-country analyses (Eggoh et al., 2015).

The coefficient for gross capital formation in the short run is -0.0153, though it is statistically insignificant, indicating no meaningful short-term relationship with economic growth. Life expectancy rate is the only variable with a positive coefficient in the short run (0.7058), too lacks statistical significance. The coefficient for infant mortality rate is negative and statistically insignificant. The overall model fit, as indicated by an F-statistic of 4.17, is significant at the 5% level, suggesting that the explanatory variables collectively have a meaningful impact, despite individual variables lacking consistent significance.

Table 6a. Summary for unit root test

| Variables | ADF Test at Level | ADF Test at first Difference | PP Test at Level | PP Test at first Difference |
|---|---|---|---|---|
| Ln GDP | -1.938 | -9.769 | -2.138 | -9.769 |
| Ln GCF | -2.190 | -10.397 | -2.198 | -8.788 |
| Ln Health Eexpenditure | -2.371 | -10.765 | -2.522 | -10.765 |
| Ln LER | -2.628 | -11.073 | -2.648 | -11.092 |
| Ln MR | -2.551 | -11.028 | -2.522 | -11.040 |

Table 6b. Critical values for ADF and PP unit root tests at different significance levels.

| Test/Probability | One percent | Five percent | Ten percent |
|---|---|---|---|
| ADF at Level | -3.486 | -2.886 | -2.579 |
| ADF at 1st Difference | -3.486 | -2.886 | -2.579 |
| PP at Level | -3.486 | -2.886 | -2.579 |
| PP at 1st Difference | -3.486 | -2.886 | -2.579 |

Table 7. Results.

| Variables | Coefficient | Std. ERROR | T-Statistics | Prob |
|---|---|---|---|---|
| C | -0.7516 | 0.07790 | -9.6374 | 0.0000 |
| LN GHE | -2.0608 | 1.2908 | -1.5964 | 0.1143 |
| LNGCF | -0.0153 | 0.0228 | -0.6688 | 0.5055 |
| LNLER | 0.7058 | 2.3952 | 0.2947 | 0.7690 |
| LNMR | -0.5166 | 0.5267 | -0.9809 | 0.3295 |
| R-squared | 0.2255 | Mean dependent var | | 0.0533 |
| Adjusted R-squared | 0.1716 | S.D / dependent var | | 2.7752 |
| S.E regression | 16009.41 | Akaike info criterion | | 3.7039 |
| F-statistics | 4.187 | Schwarz criterion | | 4.6331 |
| Prob of F-statistics | 0.0002 | Durbin-Watson criterion | | 2.0938 |

Table 8 presents the outcomes of the ARDL bounds test for co-integration, which evaluates whether a long-term relationship exists among the variables. The computed F-statistic (Wald Test) of 8.81 surpasses the upper bound critical value of 4.01 at the 5% significance level. This result leads to the rejection of the null hypothesis of no co-integration, supporting the alternative hypothesis that a long-run equilibrium relationship is present. Consequently, the analysis indicates that, in South Asian countries, economic growth is associated in the long term with health expenditure and the other explanatory variables included in the model.

Table 9 demonstrates that health expenditures contribute positively to economic growth, but, statistically speaking, these contributions are not substantial. It can be deduced from this that an increase of one unit in health spending will result in a rise of 1.2525 units in GDP over time. It has also been proven by Rehman et al. (2018) and Gizem (2018). Additionally, Dreger and Reimers (2005) reached similar conclusions. The conclusion that can be drawn is that there is a positive association between the health expenditures of South Asian nations and their economic growth, but that this correlation is not statistically significant. Gross capital formation has been a substantial contributor to economic development, particularly during the most extended period. It is clear from the findings that the positive slope of 0.1589 for gross capital formation indicates that it is making a significant contribution to the expansion of the economy. It was stated that an increase in gross capital formation will result in a 0.1589 percentage point increase in GDP for each year that passes. The conclusion that can be drawn from this is that there is a positive and significant relationship between the rise in gross capital formation and the expansion of the economy. In the long term, the life expectancy rate and the infant mortality rate have been found to have a positive correlation with economic growth. The probability values of both variables are high, starting at 0.05, indicating that the variables are not significant. The findings concerning the variables indicate that the life expectancy rate and the infant mortality rate, both of which had a positive slope of 1.4443 and 0.2252, respectively, contributed to the expansion of the economy.

Tables 10a and 10b represent the Granger Causal Results in couples. Additionally, causality analysis was applied to determine the direction of the relationship between the study's variables. The findings revealed that, over a one-period lag, there was no evidence of a causal relationship between health expenditure and economic growth, gross capital formation, life expectancy rate, and mortality rate. However, the GDP found a Granger causality to gross capital formation. The gross capital formation also Granger causes government health expenditure.

Table 8. Bounds test for co-integration analysis.

| Test statistics | VALUE | K |
|---|---|---|
| F Statistics (Wald test) | 8.81 | 4 |
| Critcial values bounds | | |
| Significance | LOWER BOND VALUE | UPPER BOUND VALUE |
| 10 % | 2.45 | 3.522 |
| 5 % | 2.86 | 4.01 |
| 2.5 % | 3.25 | 4.49 |
| 1 % | 3.74 | 5.06 |

Null Hypothesis: No long-run relationship exists.

Table 9. Long run model estimation.

| Variables | Coefficients | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| LNGHE | 1.2525 | 1.9545 | 0.6408 | 0.5235 |
| LNGCF | 0.1589 | 0.0279 | 5.6901 | 0.0000 |
| LNLER | 1.4443 | 1.0861 | 1.3298 | 0.1874 |
| LNMR | 0.2252 | 0.2058 | 1.0942 | 0.2771 |

Table 10a. Pair-wise Granger Causality test.

| Null Hypothesis: | Obs. | F-Statistics | Prob. |
|---|---|---|---|
| LNGHE Does Not Granger Cause LNGDP | 114 | 1.9035 | 0.1705 |
| LNGDP Does Not Granger Cause LNGHE | | 0.9643 | 0.3282 |
| LNGCF Does Not Granger Cause LNGDP | 114 | 1.1324 | 0.2896 |
| LNGDP Does Not Granger Cause LNGHE | | 4.1901 | 0.043 |
| LNLER Does Not Granger Cause LNGDP | 114 | 0.0627 | 0.8027 |
| LNGDP Does Not Granger Cause LNLER | | 1.5112 | 0.2216 |
| LNMR Does Not Granger Cause LNGDP | 114 | 0.1652 | 0.6852 |
| LNGDP Does Not Granger Cause LNMR | | 5.4099 | 0.0218 |
| LNGCF Does Not Granger Cause LNGHE | 114 | 7.0589 | 0.0091 |
| LNGHE Does Not Granger Cause LNGCF | | 0.0761 | 0.7832 |
| LNLER Does Not Granger Cause LNGHE | 114 | 1.4578 | 0.2298 |
| LNGHE Does Not Granger Cause LNLER | | 49.4103 | 2.231 |
| LNMR Does Not Granger Cause LNGHE | 114 | 3.0505 | 0.0835 |
| LNGHE Does Not Granger Cause LNMR | | 0.1453 | 0.7038 |
| LNLER Does Not Granger Cause LNGCF | 114 | 0.0345 | 0.8531 |
| LNGCF Does Not Granger Cause LNLER | | 0.0751 | 0.7846 |
| LNMR Does Not Granger Cause LNGCF | 114 | 0.2018 | 0.6541 |
| LNGCF Does Not Granger Cause LNMR | | 0.3742 | 0.542 |
| LNMR Does Not Granger Cause LNLER | 114 | 100.834 | 3.1734 |
| LNLER Does Not Granger Cause LNMR | | 41.1286 | 4.0976 |

Table 10b. Granger Causality test decision criteria.

| Description of Causality | P-values | lag | Decision | Outcome |
|---|---|---|---|---|
| LN GHE > LNGDP | 0.1705 | 1 | Do Not Reject Null Hypothesis | LNGHE Does Not Granger Cause LNGDP |
| LNGDP> LNGHE | 0.3282 | 1 | Do Not Reject Null Hypothesis | LNGDP Does Not Granger Cause LNGHE |
| LNGCF>LNGDP | 0.2896 | 1 | Do Not Reject Null Hypothesis | LNGCF Does Not Granger Cause LNGDP |
| LNGDP>LNGCF | 0.0430 | 1 | Reject Null Hypothesis | LNGDP Granger Cause LNGCF |
| LNLER>LNGDP | 0.8027 | 1 | Do Not Reject Null Hypothesis | LNLER Does Not Granger Cause LNGDP |
| LNGDP>LNLER | 0.2216 | 1 | Do Not Reject Null Hypothesis | LNGDP Does Not Granger Cause LNLER |
| LNMR>LNGDP | 0.6852 | 1 | Do Not Reject Null Hypothesis | LNMR Does Not Granger Cause LNGDP |
| LNGDP>LNMR | 0.0218 | 1 | Reject Null Hypothesis | LNGDP Granger Cause LNMR |
| LNGCF>.LNGHE | 0.0091 | 1 | Reject Null Hypothesis | LNGCF Granger Cause GHE |
| LNGHE>LNGCF | 0.7832 | 1 | Do Not Reject Null Hypothesis | LNGHE Does Not Granger Cause LNGCF |
| LNLER>LNGHE | 0.2298 | 1 | Do Not Reject Null Hypothesis | LNLER Does Not Granger Cause LNGHE |
| LNGHE>LNLER | 2.1034 | 1 | Do Not Reject Null Hypothesis | LNGHE Does Not Granger Cause LNLER |
| LNMR>LNGHE | 0.0835 | 1 | Do Not Reject Null Hypothesis | LNMR Does Not Granger Cause LNGHE |
| LNGHE>LNMR | 0.7038 | 1 | Do Not Reject Null Hypothesis | LNGHE Does Not Granger Cause LNMR |
| LNLER>LNGCF | 0.8531 | 1 | Do Not Reject Null Hypothesis | LNLER Does Not Granger Cause LNGCF |
| LNGCF>LNLER | 0.7846 | 1 | Do Not Reject Null Hypothesis | LNGCF Does Not Granger Cause LNLER |
| LNMR>LNGCF | 0.6541 | 1 | Do Not Reject Null Hypothesis | LNMR Does Not Granger Cause LNGCF |
| LNGCF>LNMR | 0.5420 | | Do Not Reject Null Hypothesis | LNGCF Does Not Granger Cause LNMR |
| LNMR>LNLER | 3.1734 | 1 | Do Not Reject Null Hypothesis | LNMR Does Not Granger Cause LNLER |
| LNLER>LNMR | 4.0976 | | Do Not Reject Null Hypothesis | LNLER Does Not Granger Cause LNMR |

## CONCLUSIONS AND RECOMMENDATIONS

The labour force contains a variety of personal assets, including knowledge, skills, experience, physical and mental health, and other personal qualities that are considered to be human capital. The inclusion of education, health, and abilities was included, however. When it comes to human capital, health is just as crucial as the other components. The value of healthy brains, and their contribution to the country's economy, cannot be overstated. For this reason, it has been shown that a healthy labour force is more productive than a sick one. The expenditures that are made on medical care are an essential component of effective government. No nation can achieve significant economic progress if it does not make enough investments in its human capital. It is a significant tool that may be used in the mission to alleviate poverty. Although the health sector is crucial for economic development, it receives the least attention. To strengthen the health sector, it is necessary to develop policies that benefit economically disadvantaged individuals in the area. The decision-makers in each of the selected nations must increase the amount of money they spend on the health sector. Enhancing the capabilities and capabilities of the people is of the utmost importance, and this may be accomplished by providing better educational and medical facilities. This research examined the relationship between care and economic development in South Asian nations from 2000 to 2019.

A panel of data from six different nations, including Pakistan, Bangladesh, India, Nepal, Bhutan, and Sri Lanka, supported the findings of the research. The dependent variable was the annual growth rate of GDP expressed as a percentage. The explanatory factors were the health care spending percentage of the government relative to GDP, the gross capital formation yearly growth expressed as a percentage, the life expectancy rate at birth (total), and the infant mortality rate expressed as a percentage of one thousand lives. World Development Indicators has been consulted to gather information on all relevant factors. Data from the variables that were chosen are analyzed using the ARDL model. All of the factors, except one variable, have a negative but statistically insignificant relationship with economic development, according to the findings. This is the case in the short term. There is only a positive relationship between GDP and the life expectancy rate. There is a positive correlation between the rate of life expectancy and the rise of GDP, however, this correlation is statistically insignificant. There is a positive association between all of the factors and the increase in GDP over the long term. There is a positive but statistically insignificant correlation between the government's expenditure on health and the increase in GDP. There is, therefore, a positive and significant correlation between the rise in gross capital formation and GDP growth. Accordingly, the policymakers in each of the countries selected must increase the funds they allocate to the health sector so that the living standards of their populations may be enhanced. Several policy suggestions are suggested to aid South Asian policymakers in encouraging economic development via greater investment in the health sector. Although the findings indicate a positive but statistically negligible association between healthcare expenditure and GDP over the long term, it is still recommended that these nations increase their healthcare spending. In recognition of the fact that a healthy population is necessary for continued economic output, policymakers need to match the budgets of their health sector with the standards established by the World Health Organization. Building robust health systems requires an immediate allocation of a greater proportion of GDP to the health sector, in accordance with the guidelines established by the World Health Organization. In addition, the Ministries of Health and Education need to work together to increase awareness and transmit key health information to the general community.

Additionally, prioritizing investments in health research and innovation is crucial to produce evidence-based solutions and enhance the outcomes of healthcare delivery. It is imperative that neglected and poor regions, which are characterized by insufficient healthcare facilities, receive special attention to ensure all areas have equal access to essential services. The last point is that in order to maximize the beneficial influence of healthcare services.

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