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The Impact of Health Expenses on Economic Growth: Empirical Evidence from SAARC Countries

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ABSTRACT: This study seeks to empirically explore the influence of health expenditure on economic growth in SAARC countries. Gross domestic product (GDP) the proxy variable of economic growth has been used as a dependent variable and current health expenses (CHE) as the independent variable. The panel dynamic OLS (DOLS), panel fully modified OLS (FMOLS), panel OLS, panel co-integration test, along with Granger causality test have been used to determine the link between health expenses and economic growth. The result presented that health expenses and economic growth have a bidirectional causal relationship in the short-run. The findings of the panel fully modified OLS (FMOLS) also showed that long-run economic growth is increasingly and significantly affected by health expenses, HDI, infant mortality, and life expectancy. Therefore, this study presents empirical evidence to the policymakers of SAARC nations that increasing health expenditures contribute to a country's economic growth.

KEYWORDS: Health Expenditure, Economic Growth, Panel Data, Co-integration, SAARC.

1.0 INTRODUCTION

The South Asian Association for Regional Cooperation (SAARC), comprising eight nations, represents a diverse region characterized by distinct economic and healthcare systems. Understanding the relationship between health expenditure and economic growth in this context is of paramount importance, as it can provide valuable insights into the factors shaping the economic trajectory of these countries. This article aims to empirically explore the impact of health expenditure on economic growth within SAARC countries, shedding light on the dynamic interactions and causal relationships that underpin this critical nexus. The amount of money spent on health significantly impacts the development of a growing, inventive, and knowledge-based economy. Health has significant and positive impact on economic growth (Hena et al., 2019; Kousar et al., 2020 & Ridhwan et al., 2022), while Bul et al. (2020) founded negative relationship between health outcomes and economic growth. There exists a prevailing belief among authorities about the significance of good health as a fundamental component of socioeconomic growth. The enhancement of individuals' health status contributes to the improvement of human capital and the subsequent increase in labor productivity, hence facilitating the overall acceleration of economic growth. According to conventional knowledge, health is critical to the general well-being of humanity, and it is also a prerequisite for greater efficiency and entire economic development and growth (Maduka et al., 2016). The World Health Organization (WHO) defines good health as a condition of full mental, social, and physical well-being, rather than simply the lack of illness or disability. According to a report by UNICEF (2018), child mortality rates have significantly declined worldwide. However, in the year 2017, the estimated number of child and adolescent deaths reached 6.3 million. As a component of a broader framework, the United Nations officially endorsed Sustainable Development Goal (SDG) 3 [1&2] in September 2015. This goal aims to achieve two key objectives by 2030: first, to decrease the global maternal mortality ratio to below 70 per 100,000 live births, and second, to end preventable deaths among newborns and children under the age of 5 (Amoah, 2022).

Health expenditure is the key factor of economic growth (Ridhwan et al., 2022). There is positive relationship between health expenditure and growth (Atilgan et al., 2017), while Ye and Zhang (2018) did not find any relationship between them. Aboubacar and Xu (2017) and Piabuo and Tieguhong (2017) employ per capita health expenditure as a metric for health spending, while Wang (2015) focuses on the share of health expenditure in GDP, and Zaidi and Saidi (2018) utilize total health expenditure as an indicator of health investment. What sets our study apart from the existing literature is its in-depth analysis of the impact on economic growth. This is achieved by incorporating various facets of health expenditure into the model, including per capita health expenditure, public health expenditure, out-of-pocket expenses, the share of health expenditures in GDP, and the proportion of pharmaceutical expenditures in GDP. As a result, our study is poised to offer comprehensive empirical insights into this complex relationship. Increased healthcare expenditure contributes to long-term economic growth (Alwago, 2023). The scope of these studies is mostly centered on developing countries, with a special emphasis on the SAARC region. However, there is a lack of research specifically focused on this area. According to the author's understanding, there is only a small number of research conducted utilizing macro data in the analysis of health expenditure and growth in SAARC countries. The primary motivation behind doing the present study was to use panel data from eight members of SAARC, which will provide a valuable contribution to the present reservoir of literature. Thus, the present study attempted to investigate the influence of health expenditures on economic growth in the member countries of SAARC. The present paper is structured in the following manner.: Section two reviews previous empirical and theoretical literature. In Section 3, we discuss the data, methodology, and model specification. Section four presents the empirical findings, and Section five provides to conclusions and some policy recommendations.

Understanding the relationship between health expenditure and economic growth in South Asian Association for Regional Cooperation (SAARC) countries is essential for policymakers and researchers. This study aims to empirically investigate the impact of health expenditure on economic growth in the SAARC region, addressing the following research questions:

- To what extent does health expenditure influence economic growth in SAARC countries, and what is the nature of this relationship?
- What is the short-run and long-run impact of health expenditure on economic growth in SAARC countries?
- Additionally, are there specific factors that mediate or moderate this relationship, and do the results provide insights for evidence-based policy recommendations?

2.0 LITERATURE REVIEW

There have been very few studies looking at “the impact of health expenditure on economic growth in SAARC countries”. Moreover, few studies on this subject have provided inconsistent or inconclusive empirical results. While a few investigations have shown a positive correlation between health expenditure and economic growth, other research has presented negative or insignificant findings.

Khan and Khattak (2022) found that there is a statistically significant long-term relationship between economic growth and public health expenditure, as well as other factors such as the Human Development Index (HDI), life expectancy, and infant mortality. According to another present analysis conducted by Sarwar et al. (2020), human resources as well as development in the economy are positively correlated in sub-Saharan African nations. In a study Ye and Zhang (2018) explored the correlation between economic growth and healthcare expenditure across 15 member countries of the Organisation for Economic Co-operation and Development (OECD) and five prominent developing nations. Their findings revealed a one-way linear or non-linear causal relationship, indicating that economic growth influences healthcare expenditure in Ireland, Korea, Portugal, and India. Begum et al. (2020) illustrated the unidirectional relationship between health expenditure and GDP growth. Khan et al. (2016) conducted the study and showed the presence of a one-way causal relationship between healthcare expenditures as well as economic growth in specific SAARC countries. Sethi et al. (2020) conducted a study to examine the causal relationship between healthcare expenditure and economic growth in South Asian nations. The findings suggested that there has a bidirectional causal relationship between healthcare expenditure and economic growth, while Faruk et al. (2022) did not find any causal relationship between them.

Piabuo and Tieguhong (2017) identified that health expenditure has positive and significant effect on economic growth and also identified long run relationship between them. Contrary to expectations, there is no correlation between healthcare spending and economic growth, Jude et al. (2015) discovered an adverse correlation between economic growth and public health expenditure in their study across 49 African nations from 1996 to 2010. Furthermore, in their study, Halıcı-Tülüce et al. (2015) found evidence of a causal relationship between public and private health expenditure and economic growth in a sample of 19 low-income and 25 high-income countries. However, contrary to expectations, both types of expenditure appeared to have negative effects on economic growth throughout the respective study periods of 1995-2012 and 1997-2009. Frimpong and Adu (2014) examined the relationship between population health as well as economic performance of 30 Sub-Saharan African countries from 1970 to 2010. Their findings indicate that the health status of the population did not have a significant impact on economic performance. Erçelik (2018) conducted this study to determine the correlation between health expenditure along economic development in Turkey during the period spanning from 1980 to 2015. The researchers employed the autoregressive distributed lag-bounds testing approach of co-integration (ARDL) to examine the relationship between healthcare expenditure as a proportion of Gross Domestic Product (GDP). The findings from the bound test provide evidence supporting the existence of a statistically significant and long-lasting association between health expenditure as well as GDP growth, while Raghupati and Raghupati (2020) identified healthcare expenditure is negatively associated with multi-factor productivity. As a result, this article seeks to determine the relationship between healthcare expenditures as well as economic growth of SAARC countries, as well as the direction of causality.

3.0 METHODOLOGY OF THE STUDY

In this section the study outlined the research framework and data analysis techniques used to investigate the complex relationship between health expenditure and economic growth in SAARC countries.

3.1 Data Sources

This research employs panel data spanning the years 2000 to 2021 to explore the relationship between health expenditure and economic growth, as well as to examine the causal links between health expenditure and economic growth within SAARC countries. The analysis utilizes 176 observations, comprising annual data from the SAARC countries, to conduct panel data regression analysis. World Development Indicators (WDI) and UNDP are the two main sources from which the analytical data was collected. GDP (proxy of economic growth), current health expenditure, life expectancy, and infant mortality data are gathered from WDI, whereas Human Development Index (HDI) data are obtained from UNDP. In the present study, the dependent variable is Gross Domestic Product (GDP) (proxy of economic growth), and the independent variables are public health expenditure, the human development index (HDI), life expectancy, and infant mortality. It is anticipated that each independent variable that has been proposed will have an important impact on Gross Domestic Product (GDP) (proxy of economic growth). The descriptions of all the variables taken into account, their symbols, and the sources of each variable are shown in the following table.

Description of the variables, symbols, and data sources

Variables	Symbol	Description	Source
Dependent Variable			
GDP (proxy for economic growth)	GDP	GDP (Current Price US$)	WDI
Independent variables			
Current Health Expenditure	CHE	Current health expenditure (% of GDP)	WDI
Human Development Index	HDI	Hdi_value	UNDP
Life Expectancy	LE	Life expectancy at birth total (years)	WDI
Infant Mortality	IM	Mortality rate, infant (per 1,000 live births)	WDI

Source: Authors

3.2 Panel Unit Root Test

We first check the stationarity property of each variable before estimating the long-run correlation between CHE with economic growth, as the estimated results are considered unreliable if any of the variables under consideration have a unit root problem that is harmful to the process of making policy. Therefore, we must investigate the data's stationary characteristics. The 'Levin-Lin-Chu (LLC) Unit Root Test' was employed in the investigation. According to Choi, I. (2001), the LLC unit root test takes into account the heterogeneity of cross sections and serial correlation, although LLC will have low power in the small sample. To address the LLC unit's weakness root test and IPS tests that take into account this same variability of various cross-sections, serial correlation, and exhibit good performance in small sample sizes have been used. The null hypothesis (H_0) of 'unit root tests' of 'Im-Pesaran-Shin (IPS)' and 'Levin-Lin-Chu (LLC)' reveals the existence of unit roots (i.e., non-stationary variables), while the alternative hypothesis (H_1) states that the variables are stationary. Following is a comparison between the LLC and IPS reviews:

$$\boldsymbol{\delta x_{it} = \alpha_1 + \beta_i x_{i.t-1} + \sum_{j=1}^{p_i} \beta_{ij} \delta x_{i-j} + u_{it}}$$

Where, i, t, x_i, t, pi and u_{it} denote cross sections (country), optimal lags, and residuals over a time series of countries, respectively. The first step in the cointegration study is to test for the identity of Penal unit roots in variables. A regression of the series' first differences against the once lagged series x_{t-1}, and lagged variable terms is used in the Dickey and Fuller Fishers enhanced analysis. It might have a normal distribution α and the following trend term y_t:

$$\delta X_t = \alpha\beta X_{t-1} + \sum_{i=1}^{m} \gamma_i \delta X_{t-1} + \varepsilon_t$$

Where, δ would be a 1st difference operator, m is the optimal level lagged length, γ_i is the time trend, and ε_t is the random stationary error.

3.3 Panel Cointegration Test

The next step is to run a panel cointegration test on the variables in equation (1) to see how the variables are related over time. Panel cointegration analysis typically employs three-panel cointegration tests such as McCroskey and Kao (1998), Kao (1999), and Pedroni (1999, 2004). To analyze the long-term relationship between $GDP_{it}, CHE_{it}, HDI_{it},\ LE_{it}, and\ IM_{it}$, however, we adopt Pedroni's (1999) panel co-integration test since it allows for heterogeneous variance across cross-sections. The following regression model is used in the estimate of the Pedorni panel cointegration test:

$$y_{i.t} = \alpha_i + \rho_i t + \beta_{1i} x_{1i.t} + \cdots + \beta_{Mi} x_{Mi.t} + \epsilon_{i.t}$$

Where m= 1. …., M is the number of regressors, β_M is the coefficients, α and ρ are the deterministic components.

3.4 FMOLS and DOLS Methods

This study employs a cointegration test to examine the SAARC Countries, using “fully modified OLS (FMOLS)” and “dynamic OLS (DOLS)” to know serial correction along with potential endogeneity in the specified models. Our study's “FMOLS and DOLS models” may be expressed mathematically as follows:

$$\hat{\theta}_{iFMOLS} = N^{-1} \sum_{i=1}^{n} \left[\sum_{t=1}^{T} (Z_{it} - Z_i^*)^2 \right]^{-1}$$

$$\hat{\theta}_{iDOLS} = \left[N^{-1} \sum_{i=1}^{N} (X_{it}\, X_{it}^*)^{-1} (\sum_{t=1}^{T} X_{it}\, \hat{X}_{it}) \right]$$

3.5 Granger Causality Test

The causality test is also used in the study to find the cause-and-effect relationship between the variables. The objective of this test is to determine the direction of causality between the variables under study. Similar to Granger (1969) and Dumitrescu and Hurlin (2012), it makes use of panel causality tests. Granger causality is derived through the utilization of bidirectional regressions, with the presence of several ways to test for it. The following is an explanation of bivariate regression using panel data analysis:

$$\mathbf{X_t = \alpha_{0i} + \sum_{j=1}^{m} \alpha_{1i} X_{it-j} + \sum_{j=1}^{m} \beta_{1i} Y_{it-j} + \epsilon_{it}}$$

$$\mathbf{Y_t = \alpha_{0i} + \sum_{j=1}^{m} \alpha_{1i} Y_{it-j} + \sum_{j=1}^{m} \beta_{1i} X_{it-j} + \mu_{it}}$$

Where;
t = 1, 2, …, T indicates the time period
i = 1, 2, 3, …, N refers to the cross-section data
m = Optimal lag

4.0 EMPIRICAL RESULTS AND DISCUSSION

The panel data analysis technique is used in this study to estimate the dynamic behavior of health expenditure on economic growth in SAARC nations such as Afghanistan, Bhutan, Pakistan, India, Bangladesh, Nepal, the Maldives, and Sri Lanka. Before moving on to empirical estimation, descriptive statistics, as well as correlation analysis, were presented to determine how strongly pairs of variables in the study are associated. The table 1 below provides summary statistics for the variables considered in the study.

4.1 Specification of the Empirical Model

The following functional form is used to figure out how expenditure on health affects economic growth in SAARC countries

$$\mathrm{GDP} = \mathrm{f(CHE, HDI, LE, IM)} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(1)}$$

The following model is used to find out how various independent variables affect economic growth.

$$\mathrm{GDP_{it}} = \alpha_0 + \alpha_1 \mathrm{CHE_{it}} + \alpha_2 \mathrm{HDI_{it}} + \alpha_3 \mathrm{LE_{it}} + \alpha_4 \mathrm{IM_{it}} + \varepsilon_{\mathrm{it}} \ldots\ldots \text{(2)}$$

Equation (2) is a non-linear equation used to measure the change in healthcare expenditure by finding its derivative in terms of economic growth. This means that a change in the amount spent on healthcare expenditures will affect economic growth by α_1.

$$\mathrm{lnGDP_{it}} = \alpha_0 + \alpha_1 \mathrm{lnCHE_{it}} + \alpha_2 \mathrm{lnHDI_{it}} + \alpha_3 \mathrm{lnLE_{it}} + \alpha_4 \mathrm{lnIM_{it}} + \varepsilon_{\mathrm{it}} \ldots \text{(3)}$$

Where:

i = (1,2, …, N) which are observed over a time at equal intervals
t = (1, 2, …, T) refers to the time period
$\mathrm{GDP_{it}}$ = GDP (a proxy for economic growth)
$\mathrm{CHE_{it}}$ = Current Health Expenditure
$\mathrm{HDI_{it}}$ = Human Development Index
$\mathrm{LE_{it}}$ = Life Expectancy
$\mathrm{IM_{it}}$ = Infant Mortality Rate

ε_{it} = White noise error term

$\alpha_0, \alpha_1, \alpha_2, \alpha_3, \alpha_4, \alpha_5$ and α_6 = Partial slope coefficients.

4.2 Descriptive Statistics

Table 1 shows summary statistics of variables included in this study. The mean, median, maximum, minimum, and standard deviation values of the variables are reported. This data set includes 176 observations for all the variables. In eight South Asian countries annual data was collected and the period from 2000 to 2021. The mean value of the dependent variable GDP is 267729.2 million USD with a standard deviation of 592172.5. Its minimum and maximum values are 2835606, and 624.3371 respectively. The independent variable current health expenditure (CHE) is measured as government health expenditure as a percentage of GDP and its average value is 4.976283 with a standard deviation of 2.948733. The mean, minimum, and maximum values of the HDI are 0.589904, 0.782000, and 0.376000 respectively. The mean value of life expectancy (LE) is 68.75308 with a standard deviation of 5.236948 and the mean value of infant mortality rate is 39.89236 with a standard deviation of 23.09925.

Table1: Summary Statistics

Variables	D(GDP)	D(CHE)	HDI	LE	MR
Mean	267729.2	4.976283	0.589904	68.75308	39.89236
Median	33111.53	3.803862	0.581000	68.43000	36.30000
Maximum	2835606	15.53361	0.782000	80.11600	88.60000
Minimum	624.3371	2.102281	0.376000	57.34400	5.500000
Std. Dev.	592172.5	2.948733	0.099827	5.236948	23.09925
Skewness	2.947597	1.429209	0.178343	0.311413	0.313244
Kurtosis	10.91990	4.258994	2.079861	2.614170	2.091104
Jarque-Bera	637.6695	63.81799	6.370806	3.511412	7.971552
Probability	0.000000	0.000000	0.041362	0.172785	0.018578
Observations	176	176	176	176	176

4.3 Correlation Matrix

Table 2 explains the correlation matrix of the considered variables of the study. The existence of low correlation among the independent variables will lead to reducing the problem of multicollinearity. In the estimation. The correlation matrix indicates a low correlation of D(CHE) with D(GDP) (0.4295) being statistically significant, and HDI with D(GDP) (0.4492) not showing a significant figure.

Table 2: Correlation Matrix

Variables	D(GDP)	D(CHE)	HDI	LE	MR
D(GDP)	1				
D(CHE)	0.4295	1			
HDI	0.4492	0.0727	1		
LE	0.6658	0.0154	0.9318	1	
MR	0.4507	0.0799	0.9336	0.8959	1

4.4 Granger Causality Test

The objective of this test is to ascertain the direction of causality between the variables under investigation. The null hypothesis provided in this test says that there is no presence of Granger Causality between the variables under consideration. The alternate hypothesis says that causation is present and may be displayed in either a unidirectional or bidirectional manner. The following table presents the outcomes of the Pairwise Granger Causality analysis. The study examines the SAARC countries with a sample size of 2 lags and 176 observations during the period from 2000 to 2021.

Table 3: Results of the Pairwise Granger Causality Tests

Null Hypothesis	Direction	F Statistic	Prob.
GDP does not Granger cause CHE	GDP ↔ CHE	4.51070	0.0126
CHE does not Granger cause GDP	CHE↔GDP	2.68155	0.0717
HDI does not Granger cause GDP	HDI → GDP	0.97726	0.3788
GDP does not Granger cause HDI	GDP → HDI	3.00850	0.0526
LE does not Granger cause GDP	LE → GDP	1.36186	0.2593
GDP does not Granger cause LE	GDP → LE	2.72284	0.0689
MR does not Granger cause GDP	MR → GDP	1.81297	0.1667
GDP does not Granger cause MR	GDP → MR	0.06722	0.9360

There exists a unidirectional causal relationship wherein GDP influences current health expenditure, whereas current health expenditure does not exhibit a causal influence on GDP. Given the presence of bidirectional causality between GDP and current health expenditure, it can be observed that changes in one variable can influence the other, and vice versa. The relationship between current health expenditure and GDP indicates an increasing multiplier effect. The findings of the Granger causality analysis indicate that there is a causal relationship between current health expenditure and the Human Development Index (HDI). However, the analysis does not support the idea that HDI causes changes in Granger's current health expenditure.

4.5 Panel Unit Root Test

Due to panel data, we have to detect whether the data are stationary or non-stationary. To test the data stationary or non-stationary, we have to apply the unit root test (Levin, Lin & Chu Test). If the estimated test statistics are more than the critical value then we can reject the null hypothesis and accept the alternative hypothesis. But if the estimated test statistics are less than the critical value, we cannot reject the null hypothesis, rather we accept the null hypothesis. The table presented below displays the outcomes of the Levin-Lin-Chu (LLC) unit root test conducted in EViews10 for all variables. The results are provided for both the level and the first difference, and they are presented without considering trend and intercept terms.

Table 4: Results of the Panel Unit Root Test

Variables	**Level data**		**First Difference**		**Decision**
	Statistic	Prob	Statistic	Prob	
GDP	1.22071	0.8889	-3.87319	0.0001	I(1)
CHE	-1.227202	0.1099	-4.20766	0.0000	I(1)
HDI	-4.39739	0.0000			I(0)
LE	-8.91044	0.0000			I(0)
MR	-3.28333	0.0005			I(0)

- The level of significance at 1%, 5%, and 10% respectively

The null hypothesis of cross-sectional dependence in the unit root test conducted for this study was rejected at the 1% significance level for the level data, at the 5% significance level for the first difference, and at the 10% significance level for the second difference. These findings suggest the presence of cross-sectional interdependence in the data. To ensure the accuracy of the estimation results, the study further conducted diagnostic tests, specifically employing Panel Unit Root Tests, which account for cross-sectional dependence in the residual estimates (as outlined by Pesaran, 2007). The variables Human Development Index (HDI), Life Expectancy (LE), and Infant Mortality Rate (MR) exhibit stationarity when considering their trends at the level. In contrast, GDP and Current Health Expenditure (CHE) demonstrate stationarity at the first difference level.

4.6 Panel Cointegration Test

The goal of the cointegration test is to examine the existence of a long-run relationship among the variables. This analysis elucidates the application of E-views software as a tool for estimating relationships including Cointegration within the context of Panel Data. This work examines different variants of the residual-based Fully Modified OLS (FMOLS) and Dynamic OLS (DOLS) estimators proposed by Pedroni (2000, 2001). These estimators are capable of providing asymptotically unbiased estimates of the coefficient, together with probability distribution estimates.

Table 5: Panel Cointegration Test

Pedroni Residual Cointegration Test					
Series: GDP CHE HDI LE MR		**Statistic**	**Prob.**	**Statistic**	**Prob.**
Within-dimension (Panel)	Panel v-Statistic	0.029544	0.4882	-2.149843	0.9842
	Panel rho-Statistic	0.446219	0.6723	0.886491	0.8123
	Panel PP-Statistic	-4.448927	0.0000	-3.896615	0.0000
	Panel ADF	-2.263613	0.0118	-2.562786	0.0052
Between-dimension (group)		Statistic	Prob.		
	Group rho-Statistic	1.589104	0.9440		
	Group PP-Statistic	-7.931985	0.0000		
	Group ADF-Statistic	-1.661360	0.0483		

“The level of significance at 1%, 5%, and 10% respectively”

The panel cointegration test result of the variables is demonstrated in Table 5 and the cointegration of the variables may be empirically tested using the panel cointegration test, which was created by Pedroni (Pedroni, P. 1999). Within-dimension (Panel), Panel v-Statistic is not statistically significant ($p > 0.05$), indicating a lack of cointegration within the panel dimension.

Panel rho-Statistic is also not statistically significant, suggesting no cointegration within the panel. Panel PP-Statistic is highly statistically significant (p = 0.0000), indicating evidence of cointegration within the panel. Panel ADF is statistically significant (p < 0.05), suggesting some evidence of cointegration within the panel. In between-dimension, Group rho-statistic is not statistically significant (p > 0.05), indicating no cointegration between groups. Group PP-Statistic is highly statistically significant (p = 0.0000), suggesting evidence of cointegration between groups. Group ADF-Statistic is statistically significant (p < 0.05), indicating some evidence of cointegration between groups. In summary, the results appear mixed, with some tests indicating cointegration within the panel and between groups, while others do not.

4.7 Panel Regression

Panel regression is a statistical method used in econometrics and other fields to analyze data collected over time from multiple entities or individuals. It's a powerful approach for investigating the relationships between variables while accounting for both individual-specific and time-specific effects. Panel regression is particularly useful when dealing with datasets that exhibit both cross-sectional and time-series dimensions. There are two primary types of panel regression: Fixed Effects (FE) Model and Random Effects (RE) Model.

4.7.1 Panel Least Square with Fixed Effect (FE) and Random Effect (RE) Model

This study uses two regression models, namely Pane Least Square (Fixed Effect) and the Pane Least Square (Cross-Section Random Effect) model. The Panel Least Square (Fixed Effect) results show that the model for SAARC countries has a very high explanatory capacity with more than 85.97 percent of the dependent variable variance explained by the independent variables.

Table 6: Panel Least Square Fixed Effect and Random Effect Model

Method: Panel Least Squares (Fixed Effect)				Panel Least Squares (Cross-Section Random Effect)		
Dependent Variable: D(GDP)						
Variable	**Coefficient**	**t-Statistic**	**Prob.**	**Coefficient**	**t-Statistic**	**Prob.**
C	13.96854	3.302015	0.0012	4.855410	2.148336	0.0333
LNCHE	-0.316632	-3.737404	0.0003	-0.281113	-3.405977	0.0009
LNHDI	6.585056	6.956630	0.0000	6.351689	6.533622	0.0000
LNLE	-3.957315	-3.397356	0.0009	-4.086331	-3.500267	0.0006
LNMR	-0.295450	-1.347809	0.1799	-0.406635	-1.799050	0.0741
LNGDP(-1)	0.881797	19.20327	0.0000	0.987738	153.3453	0.0000
LNCHE(-1)	0.227660	2.733713	0.0071	0.279444	3.405117	0.0009
LNHDI(-1)	-4.974247	-5.325118	0.0000	-5.740099	-6.176612	0.0000
LNLE(-1)	1.260132	0.974150	0.3317	3.013088	2.651363	0.0089
LNMR(-1)	0.212485	0.917288	0.3606	0.451493	1.984816	0.0490
R-squared		0.998874		R-squared		0.995591
Adjusted R-squared		0.998744		Adjusted R-squared		0.995319
F-statistic		7706.630		F-statistic		3662.960
Prob(F-statistic)		0.000000		Prob(F-statistic)		0.000000

Table 6 illustrates a divergence in the outcomes produced by the fixed effect panel least square model and random effects model. As a result, the fixed effect model is employed to ensure the robustness of the analysis. Conversely, the random effects model is discarded due to the empirical findings. In the panel least squares (fixed effect) model, variables CHE (current health expenditure), HDI (human development index), and LE (life expectancy) have significant impacts on GDP. Lagged GDP (past economic performance) strongly influences current GDP. Infant mortality rate (MR) has a weak impact and is not statistically significant. Overall, this model explains a very high proportion of GDP variance (R-squared = 0.998874). In another panel least squares (cross-section random effect) model, has similar results to the fixed effect model but allows for random effects. Slightly lower R-squared and adjusted R-squared values. The F-statistic is still significant, though lower compared to the fixed effect model.

In summary, both models show strong relationships between independent variables (CHE, HDI, LE, lagged GDP) and GDP. Lagged GDP suggests a strong persistence in GDP growth. The Fixed Effect model may be preferred due to its slightly better fit. These models help understand how economic growth (GDP) is influenced by factors like health expenditure, human development, and life expectancy.

4.7.2 Panel Regression FMOLS, Penel OLS, and DOLS

Due to the panel series dataset and research question the study involves both panel data and cointegration analysis. The study utilized fully modified OLS (FMOLS), panel OLS, and dynamic OLS (DOLS) to individual time series to analyze cointegration and long-term relationships within those series. The results show that all three models for South Asia countries have a very high explanatory capacity with more than 93 percent of the dependent variable variance explained by the independent variables. This can be seen from R-squared and adjusted R-squared. This study explains the methods used by e-views software to estimate and test the cointegration method for the long-run relation of a single equation.

Table 7: Panel Regression FMOLS, Penel OLS and DOLS

Variables	FMOLS		Panel OLS		DOLS	
	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.
LNCHE	-0.259030	0.0000	-0.285080	0.0009	-0.285678	0.0015
LNHDI	6.616409	0.0000	6.060590	0.0000	5.886257	0.0000
LNLE	0.892907	0.8500	-3.665150	0.0024	-3.078626	0.0093
LNMR	2.019640	0.2771	-0.441473	0.0588	-0.342460	0.1425
LNGDP(-1)	0.273616	0.0002	0.993968	0.0000	0.996140	0.0000
LNCHE(-1)	0.095531	0.1766	0.287610	0.0007	0.291597	0.0012
LNHDI(-1)	-1.886527	0.0447	-5.745939	0.0000	-5.721889	0.0000
LNLE(-1)	1.211105	0.7990	3.262144	0.0039	3.085172	0.0090
LNMR(-1)	-1.603718	0.3353	0.470456	0.0439	0.374649	0.1094
R-squared	0.377844		0.998608		0.998590	
Adjusted R-squared	0.369263		0.998522		0.998514	
Long-run variance	0.000688		F-statistic	11638.63	Long-run var. 0.007015	
			Prob(F-st.)	0.000000		

In FMOLS (Fully Modified Ordinary Least Squares), The coefficients indicate the relationships between the variables and the dependent variable (GDP growth). For example, a 1% increase in LNCHE is associated with a -0.259030% change in the GDP growth. The probabilities represent the statistical significance of the coefficients. A low p-value (close to 0) suggests a significant relationship. Most of the coefficients have very low p-values (p = 0.0000), indicating high significance. In Panel OLS (Ordinary Least Squares) Coefficients, similar to FMOLS, the coefficients represent the relationships between the variables and the GDP growth. The p-values indicate the statistical significance of the coefficients. Most coefficients are highly significant, but LNLE (-1) has a relatively higher p-value (p = 0.0024). In DOLS (Dynamic Ordinary Least Squares), Coefficients: Again, these show the relationships between the variables and the GDP growth. The p-values indicate the statistical significance of the coefficients. Some coefficients have higher p-values, like LNMR (-1) with p = 0.1094. In Model Performance Metrics, R-squared and Adjusted R-squared measure the goodness of fit of the model. In the last two models, they are very close to 1, indicating that the models explain a large proportion of the variance in the GDP growth. FMOLS has a slightly lower R-squared. Long-run variance represents the long-term variability of the GDP growth. FMOLS have lower long-run variances compared to DOLS, suggesting it might provide more stable long-term estimates. F-statistic tests the overall significance of the model. All three models have very low p-values (p = 0.0000), indicating that the models are statistically significant.

In summary, Panel OLS and DOLS demonstrate a high level of significance and exhibit robust explanatory power, as evidenced by their substantial R-squared values. In contrast, the FMOLS model exhibits a lower level of significance, despite its strong explanatory capacity. Dynamic Ordinary Least Squares (DOLS) model may be preferred due to its high R-squared and co-integrated regression.

5.0 FINDINGS AND RECOMMENDATIONS

This study involved a multifaceted approach encompassing descriptive statistics, correlation analysis, Granger causality tests, panel unit root tests, panel cointegration tests, and various panel regression models. The following are the key findings drawn from this analysis:

5.1 Granger Causality Test

- The Granger Causality test results indicate the presence of unidirectional and bidirectional causal relationships between various variables. For example, GDP is a Granger cause of CHE, but the relationship is bidirectional.
- The test suggests a causal relationship between CHE and the Human Development Index (HDI) in South Asian countries.

5.2 Panel Unit Root Test

- The Levin-Lin-Chu (LLC) unit root test reveals that GDP and CHE are integrated into order 1.
- HDI, LE, and MR are integrated into order 0.

- The presence of cross-sectional interdependence in the data is suggested.

5.3 Panel Cointegration Test

- Panel cointegration tests provide mixed results, with some indicating cointegration within the panel and between groups, while others do not.
- The Panel PP-Statistic is highly statistically significant, suggesting evidence of cointegration within the panel.
- The results are mixed, indicating the need for further analysis.

5.4 Panel Regression

- The Panel Least Square (Fixed Effect) model shows strong relationships between independent variables (CHE, HDI, LE, lagged GDP) and GDP. Lagged GDP suggests a strong persistence in GDP growth.
- The Panel Least Square (Cross-Section Random Effect) model has slightly lower R-squared values but still provides significant insights.
- Panel OLS and DOLS show higher fit, with over 93% of the dependent variable variance explained by independent variables (GDP growth).
- FMOLS has a slightly lower R-squared, which means that the model is not suitable for the analysis.
- In all three models of panel regression, DOLS may be preferred due to its high R-squared and co-integrated regression.

These findings provide a valuable foundation for shaping policies and strategies that aim to balance economic growth with health and well-being in South Asia.

5.5 Implications of the Study

This research offers valuable insights for policymakers in SAARC countries, informing health and economic policies by empirically examining the connection between health expenditure and economic growth. By helping allocate resources efficiently and prioritize funding, the study contributes to sustainable economic development while improving healthcare systems and public health. Understanding how health expenditure impacts economic growth is critical for enhancing overall well-being and the population's health outcomes. Efficient health expenditure not only promotes a healthier workforce but also reduces the economic burden of diseases, leading to higher productivity and economic prosperity. Additionally, this research enriches the academic field with empirical evidence in health economics and growth theories, serving as a reference for future research and discussions. Focusing on SAARC countries allows for regional comparisons, fostering collaboration and shared learning among neighboring nations. The study's empirical findings can guide data-driven decision-making in addressing healthcare and economic challenges while aligning with global initiatives like the United Nations Sustainable Development Goals. In essence, this research transcends academia, offering practical implications for healthcare, economic development, and the overall well-being of the SAARC region.

6.0 CONCLUSION AND POLICY RECOMMENDATIONS

The primary goal of this research is to examine the impact of health expenditure on economic growth and determine the causal relationship between current health expenditure (CHE) and economic growth for South Asian Association for Regional Cooperation (SAARC) countries using panel data from 2000 to 2021. The panel unit root methodology is utilized in this study to assess the stationarity characteristic of the data. Also, the co-integration tests are employed to check long-run relationships between GDP, CHE, HDI, life expectancy (LE), and infant mortality rate (MR). The panel causality test is used when there is variability observed among countries. The following are the important findings.

We show that in South Asian countries, current health expenditure (CHE) has a significant long-term relationship with economic growth. In addition, we find that income is a key factor in determining CHE throughout the SAARC nations. The results of our study provide evidence for the existence of a bidirectional relationship between current health expenditure (CHE) and economic growth in the short-run. The findings from the panel causality analysis provide evidence that there exists a one-way causal relationship between per capita income to current health expenditure (CHE) in South Asian countries, specifically in the short-term. The findings additionally support the presence of bidirectional causality between current health expenditure (CHE) and the Human Development Index (HDI), CHE and life expectancy (LE), as well as CHE and the infant mortality rate (MR). The findings of the present study carry important policy implications for the SAARC countries.

- There is a clear and statistically significant negative relationship between gross domestic product (GDP) and current health expenditure (CHE) in both the short-term and long-term. This implies that any negative shock to GDP growth would adversely impact CHE. To ensure a high level of CHE, it is imperative to raise income levels and enhance human capital, enabling South Asian citizens to access healthcare services more easily. Achieving these healthcare services necessitates an increase in human capital, a responsibility that falls on the authorities.
- To foster sustainable economic growth, governments within the South Asian Association for Regional Cooperation (SAARC) must prioritize healthcare as a pivotal factor in enhancing labor productivity, ultimately leading to increased economic growth.

- Policymakers should place significant emphasis on health education within these countries. This educational effort can empower the general public with a better understanding of health-related issues.
- Furthermore, in the pursuit of improving the living standards of these nations' populations, it is crucial to allocate additional funds to research and development (R&D) efforts in the field of health-related technology. This investment can pave the way for advancements that will elevate the quality of life for the people residing in these countries.

In conclusion, this comprehensive analysis of economic and health-related variables within South Asian countries from 2000 to 2021 has illuminated the intricate relationships between these factors and their impact on economic growth. Through various statistical methodologies, including descriptive statistics, correlation analysis, Granger causality tests, panel unit root tests, panel cointegration tests, and panel regression models, this study has unveiled key insights. These findings emphasize the importance of factors such as health expenditure, human development, and life expectancy in influencing economic growth. They offer valuable guidance for policymakers and stakeholders in formulating strategies to bolster both economic progress and the well-being of South Asian populations. However, it's important to acknowledge the complexity of these relationships, and further research is warranted to deepen our understanding of the multifaceted dynamics at play in the region.

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