Impact of Government Health Expenditure on Economic Growth: A Comparative Study of Selected Countries

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ABSTRACT

The health sector is one of the prime indicators for the economic condition of countries. Its significance and impact on economic growth are frequently judged using the linear regression model and Solow model, which is a modified form of the Cobb-Douglas production function. We adopt the same models to signify the strength of the relationship between health expenditure and economic growth to determine the relationship between private, public, and total health expenditures and the economic growth of Australia, India, and Saudi Arabia. The analytical study found that a well-organized investment in total health enhances the overall economic growth of all countries. The selected time series data results show that the elasticity of public expenditure on health is quite similar for India and Saudi Arabia but different for the case of Australia. This reflects that India and Saudi Arabia, both developing countries, have not yet reached a level of income where the population can afford a high level of health care.

Keywords: Box and Jenkins methodology; Cobb-Douglas Function; Growth Rate; Health Expenditure; Solow Model.

INTRODUCTION

Security and human development are two important national issues that directly affect the economic growth of a country. Generally, every government aims to allocate the best possible budget to enhance human development and social comfort. To achieve these objectives, government health expenditure has a strong impact on economic growth and the social status of individuals. The 1948 Universal Declaration of Human Rights states that "everyone has the right to a standard of living adequate for the health and well-being of himself and of his family, including food, clothing, housing, and medical care." Human development is a primary goal of every individual, and good health can help one to attain it, while poor health can directly influence an individual's performance, capacity, and ability in every facet of life [1].

Scientifically advanced societies are working efficiently on human health since inventions need active and healthy brains, and a healthy population can positively contribute to the social and economic development of a country compared to a less healthy population. The reality of this can be seen from the importance of health matters in the United Nations Millennium Development Goal [2]. The welfare of people depends on the excellent performance of the health sector in every country. Chronic diseases such as HIV, AIDS, tuberculosis, and malaria adversely impact the human ability to contribute to economic development [3]. We must also understand the possible associations between economic growth and government health expenditure. A comparative study across countries on this subject provides space for better planning and the efficient allocation of resources in the health sector, as wealth and a good environment result in a healthy society [4].

Gross Domestic Product (Gdp)

One of the prominent economic indicators is GDP, which is an estimate of the monetary value of all the finished goods and services produced within a country and bought by the end user within a given period. GDP

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comprises the goods and services available for sale on the market, along with some non-market products, such as security and education services supplied by the government [5]. For GDP, market prices are measured in the following ways.

- The production approach: This approach adds the value of goods and services at each production level by calculating the total sales minus the value of the middle inputs in the manufacturing process.
- The expenditure approach: This approach includes the value of the purchases of goods and services by the last user.
- The income approach: This approach includes all the incomes of the individuals in a country along with the compensation employees receive and the operating surplus of companies.

A country's GDP is computed through a domestic statistical agency that assembles information from many sources. Economically advanced countries adhere to the international levels used to calculate GDP. These international levels of measurements for GDP are carried out through the system of national accounts under the supervision of the International Monetary Fund (IMF), European Commission Organization for Economic Cooperation and Development (ECOECD), United Nations (UN), and World Bank [6].

Capital (K)

The word capital is an abbreviated form of "Capitalis Pars debiti", the principal of a debt. In this sense, it was used during the Middle Ages and was antithetical to the interest paid. Capital refers to the production factors we use to create goods, such as equipment, tools, machinery, and computing technology. A country uses capital stock along with labor to produce goods. For the adequate development of a country, sufficient funds are needed, which is why advancement is slow in many underdeveloped countries due to the scarcity of funds [7].

Capital formation means an increment in real capital stock in an economy over a specified period. The formation of capital involves the creation of more capital goods, and this occurs when capital stock increases. The greater the capital formation of an economy, the faster it can grow its aggregate income [8]. Fixed capital covers tactile or impalpable assets manufactured as output from the production process and utilized commonly in different production processes for over a year. Gross fixed capital formation is the whole value of assets minus the distribution of fixed assets during the reference period. It also includes activities related to a certain addition to the worth of non-produced assets owing to the fertile venture of institutional components [9].

Labor Force Participation Rate

The labor force participation rate is calculated as the labor force divided by the total working-age population. This means the size of the volume of manufacturing goods and facilities compared to working-age residents. The breakdown of the labor force by gender and age group provides a profile of the distribution of the labor force within a domestic boundary [7]. Estimating the labor force participation rate requires both employment and unemployment numbers. The term employment includes all working-age persons over a particular short period, such as one week or one day. The labor force participation rate is calculated as follows:

$$\text{LFPR (\%)} = \frac{Labour\ force}{Working-age\ population} \times 100$$

$$\text{LFPR (\%)} = \frac{Persons\ employed + persons\ unemployed}{Working-age\ population} \times 100$$

From an economic point of view, the labor force of a country is analyzed using three parameters: the labor force population ratio, rate of employment of the labor force, and efficiency with respect to age, skills, and residence.

The labor force participation rate is vital in analyzing factors that decide the volume and composition of a country's human assets. The labor force is a disparate group of people; some workers are unskilled, while others are educated and industrious. The government must pay more attention to skill creation through

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education and vocational training to increase domestic output. Many females do not work due to the social and economic system [10].

Health Investment For Different Countries

The section describes the healthcare conditions in Australia, India, and Saudi Arabia and reviews their spending in the health sector. Health expenditure takes place when money is consumed on health items and facilities. This spending is needed at different levels of government and non-government organizations [11].

Health Investment in Australia: The healthcare system in Australia is recognized as one of the best in the Organization for Economic Cooperation and Development (OECD). However, it remains under immense pressure due to the constant changes needed in healthcare facilities, healthcare costs, complex healthcare conditions, and the demand for improved outcomes. The flow of money in the Australian healthcare sector is complex and is decided by government and non-government bodies [12]. The Australian government report entitled Health Expenditure Australia 2006-07 states that Australia spent over $ 94.0 billion on health in 2006-07, with 92.9% being spent on capital expenses and capitalization. This is an increase of $7.3 billion compared to 2005-06. Health expenditure in Australia in 2008-2009 was estimated to be $112.8 billion, 94.9% of which was spent on recurrent expenses and 5.1% on capital expenses. In 2012–2013, the total expenditure on health care and health facilities in Australia was $147.4 billion, which was about 1.6 times more in actual terms than expenditure in 2002-2003 but was only 1.5% more than in 2011-2012. The expenditure on health was 9.67% of GDP in 2012-13. In 2015–2017, the total health expenditure was $180.7 billion, which is about $8.1 billion more than in 2015-2016. The share expenditure on health remained stable at 10.3% of GDP from 2015-2016 to 2016-2017. In the year 2017-2018, the Australian government spent around $185.4 billion on health, which is around 10% of GDP. Over the decades, the lowest growth in health spending in terms of GDP ratio was in 2017-2018, when it reduced by 0.2%. The total spending on health in 2019–20 is estimated to be $181.8 billion, representing 16.3 percent of the Australian Government's total expenditure. In 2022–23, health spending in Australia returned to pre-pandemic levels, with an estimated $252.5 billion allocated to health goods and services, 9.9% of the GDP. After adjusting for inflation, total health expenditure was 0.3% lower than in 2021–22. This decline reflects the normalization of health spending and population growth to pre-pandemic trends.

The Australian healthcare system compares well on international levels in terms of health facilities and outcomes. However, the health requirements of the population in Australia in 2019 are very different from those in the previous year due to the increasing population and the inability to adapt quickly to new technology. Australian healthcare limitations must be addressed to provide direction for the government, financers, end users, and service providers.

Health Investment in India: The healthcare system in India is still struggling and falls behind international healthcare standards. The health sector in India receives funding from different sources such as the central government, domestic government, local government, family-held external financing organizations, and other means like NGOs. The finance from central, domestic, and local governments is allocated to public overheads. In the year 2000, the WHO ranked India 112 out of 190 countries in terms of healthcare. Despite its fast-growing economy and strong programs, India spends only 4.69% of its GDP on healthcare items and facilities. Healthcare expenditure incorporates the funding the Indian government gives to the states and domestic governments for health service activities [13]. India's per capita health overheads are 3.66% of GDP, which was about 7% in 1980. The total healthcare expenditure in India reduced from 4.3% to 3.66% between the years 2000-2016. The private health expenditure in India was 3.28% of GDP in 2014. This low level of expenditure on healthcare will have a dire impact on the creation of an effective health framework. Public health expenses are a significant part of the healthcare budget in India. In 2000-2001, the total public expenses in India were around RS 2472.33 crore, with a sharp rise of RS 37221 crore in 2014-2015 [14]. In 2017-18, the public health overheads in India were RS 20037 crore, with a vast difference between rural and urban healthcare systems. Government Health Expenditure was 1.28 percent of gross domestic product (GDP) in 2018-19, rising to 1.9 percent in 2023-24, according to the Economic Survey 2023-24. The government aims to increase public health spending to 2.5 percent of GDP by 2025, as the National Health Policy 2017 outlines. Around 70% of the residents in India reside in rural areas and have little chance to access private healthcare facilities, and they consume less than 30% of the total expenditure on healthcare.

The healthcare system in India suffers from insufficient funding. There are also many problematic structural issues, such as the lack of an organizational structure for disease control plans, subprime use of traditional medicine, and a weak administration system for drugs and medical practice in public health management.

Health Investment in Saudia Arabia: The healthcare system in Saudi Arabia is very effective and provides a charge service to all Saudi citizens and all emigrants serving in the public sector. These facilities are provided mainly through the Ministry of Health [15]. A total of $49.3 billion was allocated in the 2019 budget for health and social affairs in Saudi Arabia, which is an 8% increase compared to $45.2 billion in 2018. In the year 2022, a total of $60.7 billion was allocated for healthcare compared to $49.1 billion in 2020, which is a significant increase after COVID-19. In the year 2023, a total of $63.8 billion for healthcare is around 15% of total government spending and is the third largest recipient after education and military. Due to COVID-19, Saudi's oil revenue has recently decreased, so the Saudi government has reduced its spending across many sectors of its economy. However, its healthcare and social development budget increased by 18% in 2023. The private sector got space to invest in healthcare due to recent changes to the law. It launched a program named the National Transformation Program (NTP) to increase the privatization of government departments, including healthcare. The Saudi Arabian government is continuously working on reforms, particularly in the healthcare sector, so it is expected that both the public and private healthcare sectors will continue to grow. The statistics indicate that the healthcare sector shared 4.7% of the GDP in 2018, and it is projected to grow to 13.7% by 2025. The government decided to privatize all public hospitals and to introduce a widespread insurance system for local citizens along with Public-Private Partnership (PPP) programs. (cf. [16, 17]). Imports of medical devices accounted for more than 98% of the market at $1.8 billion, and American companies top the list of suppliers, with a 21% share of total imports. The local manufacturing industry struggles to produce medical devices and supplies only bandages, syringes, non-electrical beds, gloves, etc. The NTP program also focuses on boosting the local manufacturing industry with the help of foreign investment in the pharmaceutical sector [17].

LITERATURE REVIEW

There is extensive literature available on GDP growth and health expenditure for diverse countries, and comparative analyses have been undertaken on economic growth with respect to expenditure in the health sector. For example, [18] outlines the practical steps that need to be undertaken to use autoregressive integrated moving average (ARIMA) time series models for the predictive analysis in relation to Irish inflation. [19] built a production function model of economic growth by extending two variables: work experience and health. Jean-[20] pointed out a pattern of universal health expenditures using data from 191 countries. [21] presented a study showing that wealthier countries will have a larger slope coefficient than poorer countries when defining a relationship between healthcare expenditure and GDP. A concise study was performed by [22] to evaluate the relationship between income and the public and private healthcare expenditure of 40 states from 1990 to 2007. [23] scrutinized the relationship between per capita income and health expenditure for 16 OECD countries based on panel data from 1993-2007. [24] observed that the economic development in China and Japan can be increased by increasing the funds allocated to the health department. [25] performed a comparative analysis to determine the effects of healthcare expenses on the population's health standard. They observed the effect of public and private expenditure using panel data from 1995 to 2010. [26] studied ECO countries, where income is the top priority variable with a strong influence on health expenditure. [27] investigated the effect of private and state educational healthcare expenses on the economic growth of Iran using the auto-regressive distributed lag (ARDL) method from 1965 to 2011. [28] inspected the direction of causal relationships between healthcare expenditure and economic growth. They generated yearly data from the period 1991 to 2010 from four states in India and analyzed the data using the ordinary least squares (OLS) method. [29] described that the development of public health expenditure is essential for the social economy, according to the data set of 17 prefecture-level cities in Shandong province from 2000 to 2015. [30] describes the connection between per capita GDP and total spending on health using data from 1980 to 2015 in Turkey. They evaluated a regression model taking the GDP per capita as the dependent variable and total healthcare expenditure and investment as independent variables. [31] measured various determinants that comply with the per capita value regarding healthcare expenses, using data from 1990 to 2012 from 28 OECD countries. [32] forecasted the total health expenditure for the USA as a percentage of GDP using the autoregressive moving average (ARIMA) time series model for the period 1970-2015. [33] explored the co-integration between health spending and economic growth in Tunisia from 1985 to 2014. The trace analysis shows the existence of co-integration among the variables at a 5% confidence interval of the likelihood test (50.12160>40.17493). [34] inspected the association between the labor force participation rate for both males & females, gross fixed capital formation, and economic growth in Bangladesh from 1991 to 2017. [35] analyzed the relationship between health and economic growth in India by employing the Granger Causality test.

The main objective of this study is to identify the relationship between total healthcare expenses and economic growth in selected developing countries (India, Saudi Arabia) and one developed country, Australia. We selected these countries to confirm Scheffler's statement, "In developing countries, the slope coefficient of total health expenditure is closed, and less than one as GDP increases, while for developed countries, it is larger than one as GDP increases" Scheffler (2004). The remaining part of the article is organized as follows: The research methodology is described in section 2. Section 3 presents the analytical and comparative study. The final section, 4, gives the conclusions and recommendations.

THEORETICAL FRAMEWORK AND METHODOLOGY

This section provides a description of the methodology that is used to inspect the connection between total healthcare expenditure and economic growth. The paper explains the process of measuring the econometric analysis after using the Solow growth model, which enables it to depict and sum up the time series data using the principles of both statistical theories and economic analysis. The annual time series data is used to see the association between the total healthcare expenditure and economic growth for selected countries from both developed and developing nations ([11]. The methods and models used in this study are described as follows:

Wagner's Law: Wagner's law was introduced by Adolph Wagner (1835-1917), a German social scientist. Wagner found that as income per capita increases, public health expenditure also increases. Wagner's law states that as a country's economy progresses over time, government activities and functions also increase. He focused on the point that the main activity of a government is to meet the economic requirements of its citizens. He also stated that economic growth also grows the different layers of government, both central and state, either intensively or extensively. These observations are based on the economy of Germany, but his law can be used for both developing and developed nations. In the literature, the research community actively uses Wagner's law to validate, analyze, and develop new work; for example, [36] tested Wagner's Law for all 23 OECD countries. The empirical study reveals the consistency of the results with Wagner's statement and shows a positive correlation between public spending and GDP per capita. The results of [37] also validate Wagner's hypothesis in relation to the Greek economy, finding evidence of a positive long-run association between government expenditure and national income.

Cobb-Douglas Production Function: The Cobb–Douglas production function, named after Charles Cobb and Paul Douglas, was developed and tested against statistical evidence by Charles Cobb and Paul Douglas between 1927 and 1947. It is extensively used to characterize the association between the output variable and two input variables, such as labor and capital. This function is tested based on statistical evidence, and its mathematical model along the two factors is defined as:

$$Y=A\,L^{\beta 1}\,K^{\beta 2}, \qquad (1)$$

where Y is the total production, L is the total labor input, K is the capital input, and A is the total factor productivity. The coefficients β_1 and β_2 represent the elasticity of labor and capital or the slope coefficients, respectively. The elasticity in the output variable measures the variation in the output variable with respect to variation in the levels of labor or capital. For example, let us assume that $\beta_1 = 0.20$, the value means a 1% change in labor will lead to a 0.2% change in output ([38]. Further, if in Cobb–Douglas' production function, the values of the slope coefficients are $\beta_1+ \beta_2=1$, this shows the constant returns to scale in the production function. This relationship among slope coefficients indicates that doubling the input variables (capital (K) and labor (L)) will double output Y. Further, if $\beta_1+ \beta_2 < 1$, this means the return to scale is decreasing, and if $\beta_1+ \beta_2 >1$, it means the return to scale is increasing. In the case of perfect competition with $\beta_1+ \beta_2 =1$, this means β_1 and β_2 are the output share based on labor and capital.

Solow Criteria: In this study, a model called the neo-classical Solow production model is built to evaluate the economic growth of different countries. It is a modification of the Cobb-Douglas production function after applying a log on it. The Cobb-Douglas equation is defined as $G(C, L) = PC^{\alpha}L^{1-\alpha}$ ([39]. Here, "P," "C," and "L" are the productivity factor, capital, and labor, respectively, and the parameter "α" lies between 0 and 1. The Solow criteria illustrate how savings influence capital per worker and output per worker.

$Y_t= (C_t, P_t, L_t)$ (2)

where Y_t represents the output. Later, [40] made another modified form, added human capital, and proposed the model:

$Y_t=C_{\alpha t}\, H_{t\beta}\, (P_t, L_t)$ (3)

By taking a logarithm on both sides of Equation (3), the new transformed model becomes:

$Log\ Y_t= \alpha \log C_t+ \beta \log H_t+ \beta \log (P_t, L_t)$ (4)

The model contains output as a "Yt" factor, i.e., LogYt = Log of GDP, and the input factors such as "Ct," "Ht," and "L_t" are defined as: $LogC_t$ =Log of GCF; $LogH_t$ =Log of HCE; $LogL_t$ = Log of L. Hence, the final model is given as:

$Log\ (GDP)=\alpha+\beta_1 Log\ (GCF)+\beta_2 Log(HCE)+\beta_3 Log(L)$ (5)

DATA ANALYSES

This section describes in detail the statistical analysis of data sets from 1999-2023. The statistical analyses are based on a simple regression model and the Solow model to develop and evaluate the association between GDP and healthcare expenditures for Australia, India, and Saudi Arabia.

Healthcare expenditures and GDP: In this subsection, we investigate to what degree GDP and health expenditures are interlinked to each other, i.e., testing the elasticity of health expenditure on GDP growth. This study selects two developing countries, India, and Saudi Arabia, and one developed country, Australia. The proposed objective is to compare the two developing countries with the developed countries in relation to health expenditures and economic growth. We used the World Bank data for the period of 1999-2023 for this study (cf. www.worldbank.org). We start by considering a simple log-linear regression model to check the impact of health expenditures on GDP, and the model is given below,

$log(h) = \alpha + \beta log(y) + \epsilon$ (6)

$log(h) = 0.41 + 0.83 log(y) + \epsilon$ (6a)

$log(h) = -0.65 + 0.96 log(y) + \epsilon$ (6b)

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$$log(h) = -2.62 + 1.13log(y) + \in \quad (6c)$$

where GDP is denoted by "y" and "h" represents the health expenditures. The intercept term is denoted by "α," and "β" is the slope coefficient, and "€" is the error or unobserved random variable.

To understand the relationship between health expenditure and GDP in India, Saudi Arabia, and Australia, we used model (6). We started our analysis with India and the slope of total health expenditure with GDP. The data set indicates that health expenditure increases with an increase in GDP and decreases with a decrease in GDP. The results and estimates of the regression parameters are presented in Table 1. The P-value is < 0.05, which means the proposed model is statistically significant and can be represented by equation (6a). The elasticity β=0.83 means a 10% increase in GDP gives an 8.3% increase in total health expenditure. The literature suggests that rich countries have a large slope coefficient value for the log of GDP (Scheffler 2004).

Scheffler 2004 recommended that for developing countries, the slope value is approximated close to one, while for the richest countries, the slope of healthcare expenditure is greater than one with an increase in GDP. It can be said that if the GDP of a country increases, health expenditures will increase.

In the case of Saudi Arabia, we found a similar relationship between health expenditure and GDP as in the case of India, but with a larger slope coefficient value, which was approaching one. The data set indicates that with an increase/decrease in GDP, the health expenditure increases/decrease. Table 2 shows that the slope parameter is significant, and the model is represented by equation (6b). As the elasticity β=0.96, this shows that a 10% increase in GDP results in a 9.6% increase in total health expenditure. As far as the slope is concerned, the models of the two countries provide almost similar values.

The data set shows that for Australia, health expenditure increases as GDP increases, but after 2008, health expenditure decreases as GDP decreases, which is quite like the case of India and Saudi Arabia. It is found that the slope parameter given in equation (6c) is also significant. As the elasticity β=1.13, this means a 10% increase in GDP results in an 11.3% increase in total health expenditure. The slope value for this model is higher than the one justifying Scheffler's statement. So, we have proved our assumption that β value for Australia should exceed 1 as health care is a "luxury" good in the economy of Australia, and for developing countries, it should be less than 1.

Comparison between Public and Private Health Expenditure: Our next step is to divide the total health care expenditure into public and private to investigate if the previous assumption will hold for both government and non-government expenditure. For this matter, we use the following model:

$$log(puh) = \alpha 1 + \beta 11 log(y) + \in \quad (7)$$

$$log(prh) = \alpha 2 + \beta 21 log(y) + \in \quad (8)$$

where *"y"* represents GDP *"puh"* stands for public health expenditure and "prh" for private health expenditure. The parameters of α_1, α_2, are the intercept terms and $\beta 11, \beta 21$ are the slope coefficients where *"∈"* is an unobserved random error term.

The results of the parameters and regression for public and private health expenditure for India, Saudi Arabia, and Australia are presented in Tables 4-5, Tables 6-7, and Tables 8-9, respectively. An examination of Tables 4-9 shows that the slope parameters for India, Saudi Arabia, and Australia play a statistically significant role as their P-value is < 0.05. The models are given below:

India

$$log(puh) = -2.97 + 1.08log(y) + \in \quad (7a)$$

$$log(prh) = +2.63 + 0.61log(y) + \in \quad (8a)$$

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Saudi Arabia

$$log(puh) = -1.87 + 1.10log(y) + \in \quad (7b)$$

$$log(prh) = -0.30 + 0.93log(y) + \in \quad (8b)$$

Australia

$$log(puh) = -2.94 + 1.14log(y) + \in \quad (7c)$$

$$log(prh) = -2.75 + 1.10log(y) + \in \quad (8c)$$

From the above equations, we can observe that the elasticity of public expenditure on health is approximately the same for India, Saudi Arabia, and Australia. This means that the governments of these countries are likely to increase health expenditure even more as GDP grows. At the same time, the Australian government is likely to increase health expenditure by 11% for each 10% increase in GDP. In comparison, the Indian government is likely to increase health expenditure by only 6.1% for each 10% increase in GDP, which is the lowest of these three countries, as the Saudi government is likely to increase health expenditure by 9.0% for each 10% increase in GDP.

The above analysis shows that India and Saudi Arabia, both developing countries, have not yet reached the level of income that would make it possible for the country to afford a high level of healthcare facilities.

Empirical Test and Analysis for the Solow model: We collected data from the World Bank and then took the logarithm as described in the methodology for the Solow model. Then, we ran the regression model, and the results for the total healthcare expenditure and economic growth for India, Saudi Arabia, and Australia are given below. The empirical tests and the analysis of the Solow model for India, Saudi Arabia, and Australia are given in Tables 10-12, respectively. The fitted Solow models described in equation (5) for India, Saudi Arabia, and Australia are given as:

$$LGDP = -1.13 + 0.42LGCF + 0.27LHCE + 0.68LL \quad (9a)$$

$$LGDP = 4.14 + 0.41LGCF + 0.53LHCE - 0.30L \quad (9b)$$

$$LGDP = 5.41 + 0.34LGCF + 0.64LHCE - 0.62LL \quad (9c)$$

The model in Equation (9a) is fitted for India and indicates that the health expenditure containing a plus sign reflects a positive and direct relationship that exists between health expenditure and GDP. This indicates that in India, if there is a 10% increase in health expenditure, the GDP will increase by 2.7%. The value of R^2 for this model is very high i.e., 0.99. The R^2=0.99 means that 99% of the variation is due to HCE, GCF, and L in GDP for the period 1999-2023. The value of the standard error (SE) of healthcare expenditure is 0.13, and the coefficient of health expenditure is 0.27 (cf. Table 10). The SE of healthcare expenditure is approximately half its slope coefficient, which indicates a significant effect on GDP.

The model in Equation (9b) is fitted for Saudi Arabia, and health expenditure contains a plus sign that indicates a positive and direct relationship between health expenditure and GDP. The slope coefficient values in the model (9b) reflect that a 10% increase in health expenditure results in a 5.3% increase in the GDP in Saudi Arabia, showing a stronger impact compared to India. The value of R^2 of the model (9b) is also very high, i.e., 0.998. This high value of R^2 means that HCE, GCF, and L explain a 99.8% variation in the GDP model for the period 1999-2023. The value of the t-test statistic is 10.42 for healthcare expenditure, which means healthcare expenditure has a highly significant impact on GDP (cf. Table 11).

According to the above-fitted model in Equation (5c) for Australia, health expenditure contains a plus sign. The positive sign in the slope coefficient means a positive and direct relationship between health expenditure and GDP. The value of the slope coefficient shows that a 10% increase in health expenditure will have a 6.4% impact on GDP in Australia. The value of R^2 is very high for this model as well, showing a value of 0.9979.

This means a 99.79% variation in GDP due to "HCE," "GCF," and "L" for the period 1999-2023. The p-value is 0.0182 for health care expenditure, indicating a highly significant impact on GDP when the significance level is 5% while the converse occurs at 1%. (cf. Table 12).

CONCLUSIONS

This study determines the relationship between private, public, and total health expenditures and economic growth in the selected countries of India, Saudi Arabia, and Australia. Simple regression models and Solow models are applied to determine the association between health expenditures and GDP. The analysis shows that investment in total health promotes the growth of the entire economy in all countries. The elasticity of public expenditure on health is approximately the same for India and Saudi Arabia. Being developing countries, they have not yet reached the level of income that would make it possible to afford a high level of health care. At the same time, Australia has achieved this level, which is reflected in its being a developed nation. These findings justify Scheffler's statement that the value of the slope coefficient is higher than one for developed nations while smaller than one for developing nations.

The results of this research may be further extended, and the instability may also be controlled more precisely, although this forecast model shows a small variation in forecast error. The model may also be used in building health-related policies in Saudi Arabia because it provides reasonable results. These studies can also use Bayesian methods when parametric uncertainty is unavoidable.

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APPENDIX

Appendix A

Table-1: Regression analysis of total health expenditure in India

Variable	Coefficient	Std. Error	t-Statistic	P-value
LOGGDP	0.832330	0.043013	17.02586	0.0000
Intercept	1.407745	0.470884	2.989579	0.0104
R-squared	0.957079	F-statistic		289.8799
Adjusted R-squared	0.953777	p-value (F-statistic)		0.000000

Table-2: Regression analysis of total health expenditure in Saudi Arabia

Variable	Coefficient	Std. Error	t-Statistic	P-value
LOGGDP	0.965496	0.032256	29.93229	0.0000
Intercept	-0.293432	0.421451	-0.696242	0.5246
R-squared	0.975674	F-statistic		791.1425
Adjusted R-squared	0.972759	P-value (F-statistic)		0.000000

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Table-3: Regression analysis of total health expenditures in Australia

Variable	Coefficient	Std. Error	t-Statistic	P-value.
LOGGDP	1.130323	0.029598	38.18968	0.0000
Intercept	-2.620204	0.347137	-7.548041	0.0000
R-squared	0.991165	F-statistic		145.8452
Adjusted R-squared	0.990486	P-value (F-statistic)		0.000000

Table-4: Regression analysis of public health expenditure and GDP in India

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOGGDP	1.077784	0.095595	11.27451	0.0000
Intercept	-2.972348	1.046526	-2.840204	0.0139
R-squared	0.907219	F-statistic		127.1146
Adjusted R-squared	0.900082	P-value (F-statistic)		0.000000

Table-5: Regression analysis of private health expenditure and GDP in India

Variable	Coefficient	Std. Error	t-Statistic	P-value.
LOGGDP	0.608363	0.052616	11.56234	0.0000
Intercept	2.635840	0.576015	4.575994	0.0005
R-squared	0.911376	F-statistic		133.6876
Adjusted R-squared	0.904559	P-value (F-statistic)		0.000000

Table-6: Regression analysis of public health expenditure and GDP in Saudi Arabia

Variable	Coefficient	Std. Error	t-Statistic	P-value
LOGGDP	1.102543	0.092341	11.939907	0.0000
Intercept	-1.872547	0.902537	-2.074759	0.0548
R-squared	0.952891	F-statistic		191.1247
Adjusted R-squared	0.949987	P-value (F-statistic)		0.000000

Table-7: Regression analysis of private health expenditure and GDP in Saudi Arabia

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOGGDP	0.932748	0.047254	19.73903	0.0000
C	-0.302897	0.465142	-0.651193	0.5310
R-squared	0.972874	F-statistic		557.4661
Adjusted R-squared	0.970457	P-value (F-statistic)		0.000000

Table-8: Regression analysis of public health expenditure and GDP in Australia

Variable	Coefficient	Std. Error	t-Statistic	P-value
LOGGDP	1.143140	0.031405	36.39992	0.0000
Intercept	-2.948281	0.368335	-8.004339	0.0000
R-squared	0.990284	F-statistic		132.4954
Adjusted R-squared	0.989536	P-value (F-statistic)		0.000000

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Table-9: Regression analysis of private health expenditure and GDP in Australia

Variables	Coefficient	Std. Error	t-Statistic	P-value
LOGGDP	1.104005	0.042641	25.89095	0.0000
Intercept	-2.785792	0.500112	-5.570337	0.0001
R-squared	0.980976	F-statistic		670.3410
Adjusted R-squared	0.979512	P-value (F-statistic)		0.000000

Table-10: India Solow Model Analysis

Variable	Coefficient	Std. Error	t-Statistic	P-value
LGCF	0.417858	0.072564	5.758469	0.0001
LHCE	0.273274	0.130929	2.087195	0.0609
LL	0.682954	0.131863	5.179257	0.0003
Intercept	-1.131333	0.598000	-1.891863	0.0851
R-squared	0.994127	F-statistic		620.6501
Adjusted R-squared	0.992525	P-value (F-statistic)		0.000000

Table-11: Saudi Arabia Solow Model Analysis

Variables	Coefficient	Std. Error	t-Statistic	P-value
LGCF	0.415069	0.039843	10.41760	0.0000
LHCE	0.531952	0.069804	7.620618	0.0000
LL	-0.297147	0.173401	-1.713640	0.1146
Intercept	4.140502	1.150868	3.597720	0.0042
R-squared	0.998543	F-statistic		620.6501
Adjusted R-squared	0.998146	P-value (F-statistic)		0.000000

Table-12: Australia Solow Model Analysis

Variable	Coefficient	Std. Error	t-Statistic	P-value
LGCF	0.344467	0.124261	2.772118	0.0182
LHCE	0.638361	0.172682	3.696738	0.0035
LL	-0.615847	0.303651	-2.028137	0.0675
Intercept	5.412024	1.537973	3.518934	0.0048
R-squared	0.997948	F-statistic		1783.173
Adjusted R-squared	0.997388	P-value(F-statistic)		0.000000