INVESTMENT IN HEALTH SECTOR AND MACROECONOMIC PERFORMANCE IN US: AN EMPIRICAL INVESTIGATION.

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ABSTRACT

This empirical study examines the relationship between macroeconomic performance and US health sector spending from 1990 to 2022. Using an autoregressive distributed lag model, the study examines the dynamic relationships between real gross domestic product (RGDP) and healthcare spending (CHEXP). Finding the complex effects of healthcare investments on the larger economic environment is the main goal. The information demonstrates a robust correlation between RGDP and healthcare spending. Compared to an RGDP gain of 0.004638 units, healthcare spending has grown by one unit, with an estimated 0.004638 CHEXP coefficient. At the 5% significance level, the data statistically support the economic importance and favourable effect of healthcare spending on the nation's GDP (Prob. = 0.0337). In the research's dynamic analysis, the autoregressive distributed lag model approach is used to take into consideration both the short- and long-term impacts of healthcare spending on RGDP. Together with an assessment of the macroeconomic effect, the report provides a comprehensive examination of changes in US health sector expenditure during the last three decades. In summary, empirical data indicates that spending on healthcare improves the macroeconomic stability of the US economy. Decision-makers eager to enhance resource allocation for long-term economic development may find this research's more nuanced perspective on the financial returns on investments in the health sector useful. To fully achieve the potential of the health business as a catalyst for economic advancement, cautious investment guidance is necessary.

KEYWORDS: Investment, Health sectors, Macroeconomic, Performance and Empirical Investigation.

INTRODUCTION

In this quickly developing field of study, a lot of emphasis has been placed on the complex relationship between healthcare policy and a country's economic success. In particular, the linkage between investments in the health sector and macroeconomic performance has gained increased traction in scholarly debate, with an emphasis on comprehending the intricate interrelationships inside the United States. A thorough grasp of the field's current situation is necessary to make informed policy choices, particularly in view of the difficulties posed by global health crises and the dynamic character of healthcare systems. A nation's level of health greatly influences its production and economy.

Recent studies have highlighted the importance of health investments in relation to worker productivity and public health outcomes. Research by Xiao et al. (2020) and Alwan et al. (2022) has shown the advantages of preventive care, general health, and access to excellent healthcare.

These studies show the connection between a healthy populace and lower rates of disease, absenteeism, and the expansion of a stronger economy. These findings not only shed light on the employment effects of strategic investments in the health industry, but they also have larger social and economic ramifications.

One important aspect affecting the research's conclusions is the financial impact of healthcare expenditures. Apostolopoulos (2022) and Kimani et al. (2023) have conducted recent research that examines the complex dynamics around the effectiveness and efficiency of healthcare expenditure. These studies provide a thorough grasp of the relationships that exist between healthcare spending, resource allocation, and total economic results. This research contributes to our understanding of healthcare economics and advances the current debate on resource allocation and legislative measures that promote public health and economic stability.

A thorough grasp of the relationship between health sector investments and economic development is necessary to develop programmes that work. Researchers Wang et al. (2023) and the World Health Organisation (2022) have looked into the mechanisms by which population health promotes sustained economic growth. The research's conclusions, which are based on the most current literature, provide policymakers with crucial information to help them decide how best to allocate and invest in the health sector while maximizing any possible advantages for the macroeconomic standing of the US economy. The profession is now having trouble understanding this intricate relationship, using the US as an example, despite an increasing body of evidence connecting health sector spending to macroeconomic success. We now have a better understanding of the connection between health sector investments and both public health and economic sustainability because of recent advancements in the assessment of its component pieces. However, thorough research on the relationships between healthcare spending and affordability, accessibility, and preventative care on a variety of macroeconomic parameters in the US is still lacking. For the sake of public health and the US economy as a whole, this research challenge must act as a guide for evidence-based plans and policies that maximize investments in the health sector. After conducting a comprehensive literature review, we discovered that most published studies concentrate on the correlation between health outcomes and health finance, with a limited number of studies, especially those confined to the United States, examining the connection between macroeconomic performance and health investment. This study aims to bridge this gap by investigating the intricate relationships between macroeconomics and health investment as well as the many effects of investments made in the health sector on labour productivity, public health outcomes, economic growth, and resource allocation. By addressing these intricate connections and offering a roadmap for evidence-based programmes and policies, our research aims to maximize investments in the health sector, eventually improving public health and the US economy at large.

LITERATURE REVIEW

Several empirical studies have shown a positive relationship between life expectancy and economic development (Bloom et al., 2004; Suri et al., 2011). For instance, Acemoglu and Johnson (2007) argue that the first-order effect of higher life expectancies is population expansion, which first increases capital dilution and thereafter slows income growth. Increased economic activity will ultimately counteract the drop even if more people become active later in life; however, this compensation may not be enough if the benefits of longer life expectancies are limited.

Bloom et al. (2019) provided an overview of the many ways that health affects economic growth in developed and developing countries. The two main ways that health influences economic growth in less developed countries are the timing of long-term, sustained economic development and the change in population. Longer life expectancies have led to higher expenditures on human capital due to the extended working age (Cervellati and Sunde 2013). An improvement in population education results from the decline in mortality, which also encourages parents to have fewer children, which in turn creates an economic-demographic change. Subsequently, the demographic dividend supports the acceleration of sustainable growth. As the population becomes more productive (i.e., there is less dependence on the young and the old), investments in infrastructure, health, and education increase. This, in turn, transforms economic success into long-term, sustainable growth.

In industrialized countries, the relationship between economic progress and health is more complex. Regarding whether or not health may inhibit economic advancement in affluent countries, there are two main grounds for disagreement in the discourse (Bloom et al. 2018). First, health extends life, especially for the elderly (Breyer et al., 2010; Eggleston and Fuchs, 2012). Longer life expectancy among the elderly may increase the old-age reliance ratio, which can cause consumption to decline. The significant medical costs associated with ageing may exceed the productivity gains that come from improved health. Second, high health expenditure shares in industrialized countries may impede economic performance as a result of the "oversized" health sectors' disproportionate absorption of productive assets (Pauly and Saxena 2012). Older individuals who are less involved in the workforce disproportionately benefit from prolonged life, despite the potential increase in productivity resulting from a decrease in chronic diseases. But in industrialized nations, the advantages of even a little increase in health would most likely exceed the costs of lower consumption (Kuhn and Prettner 2016). The medical advances made possible by a large healthcare system further amplify these positive outcomes.

Research on the impact of health investment on economic growth in Nigeria from 1977 to 2010 was given by Satope et al. (2013). The research concludes that there is a long-term correlation between health spending and economic growth using the vector error correction model. The study's findings also show a favourable correlation between Nigeria's economic growth and health spending. Nonetheless, the vector error correction model's findings indicated that the relationship between health spending and economic development did not exhibit short-term convergence to long-term growth. If the government invests more in human resources related to health care, it may boost economic development. Bedir (2016) used panel data from the World Development Indicators Database (2016) together with econometric methods such as dynamic OLS (DOLS), fully modified OLS (FMOLS), and ordinary least squares (OLS) to assess the relationship between the phenomena. The study's findings demonstrated that health spending had a major and positive influence on both categories' economic development. For this study, we modified the Granger (1969) causality test to evaluate the relationship between health spending and economic growth. The Granger (1969) test was used in Europe and in developing markets in the Middle East, Africa, and Asia between 1995 and 2013. The first to implement it were Toda and Yamamoto (1995) and Dolado and Lutkepohl (1996). The investigation's findings show a reciprocal causal relationship between the Russian Federation and the Czech Republic, two European nations. South Africa, Hungary, Egypt, the Philippines, and the Republic of Korea have provided evidence that the health perspective is more important than the financial one. However, the financial perspective wins out over the health perspective in the situations of Greece, Poland, the United Arab Emirates, China, Indonesia, and South Korea. Wealth may explain a considerable amount of the cross-national differences in healthcare spending found in the empirical findings. Remember that it was shown that income acted as a mediator in the link between the rate of economic growth and the cost of healthcare? The effect of healthcare expenditure on the economic development of South Africa (SA) has been the subject of several studies. Given that economic growth in Nigeria, India, and other African countries is often linked to gains in per capita income (B.K. Gyimah & Wilson, 2015; Odior, 2011; Ogungbenle et al., 2013; Rajeshkumar, 2014), Abedir (2016) argues that a bidirectional relationship offers leverage for income. For instance, Paruk (2014) contends that the country's 2% allotment to the health budget is much less than its projected development trajectory. This may contribute to the explanation of why healthcare quality falls more precipitously in rural locations. The study's conclusions suggest that although there has recently been a rise in total public, corporate, and international investment in South African health, the benefits have mostly been fleeting.

Bidzha, Greyling, and Mahabir (2017) focus on the extent to which public health spending in South Africa improves health outcomes. They used panel estimate methodologies to research projects in nine distinct South African locales between 2005 and 2014. Their results showed a strong relationship between improvements in the birth weight and under-five mortality rate and increases in public health spending per capita. Nevertheless, studies have not shown a statistically meaningful association between economic growth and public health expenditure. Important determinants of health outcomes in the nation include variables such as the prevalence of HIV/AIDS, real GDP per capita, female literacy rate, vaccination coverage ratio, and access to formal housing. The study's findings are consistent with what is already known about the connection between healthcare spending and economic expansion. However, the inclusion of additional pregnancy and gender-related factors reveals that indices such as life expectancy, a decline in under-five mortality, and female literacy gain more significance. Moreover, Bidzha (2015) evaluated the effectiveness of South Africa's health initiatives using evidence-based policy formulation and implementation. Higher per-capita public health spending is often associated with improved health outcomes, particularly in terms of newborn death and birth weight, as demonstrated by the research findings. The projected benefits are greatest in relation to the neonatal death rate (elasticity = -0.368) and surpass life expectancy at birth (elasticity = 0.059). These figures provide credence to the theory that more public health spending leads to better health outcomes. Research has shown that the percentage of literate women and the incidence of HIV/AIDS are significant predictors of health outcomes in South Africa.

THEORETICAL REVIEW

- **Human Capital Theory**

There is a relationship between the concepts discussed in this paragraph and those pertaining to human capital. According to this economic theory, people's total human capital, which is impacted by a variety of characteristics such as health and education, determines economic development and productivity.

A thorough analysis of the topic is required to completely comprehend the possible influence of health on economic growth. From an economic perspective, being well allows people to work even when they are unwell, which boosts output and lowers employee absenteeism. Improved health reduces medical costs, which boosts productivity at work and makes picking up new skills easier. Because happy families are more likely to produce healthy children, which strengthens the economy, family happiness is important. Understanding the effects of physical health is equally important, since mental health improves a person's feeling of social involvement, sense of belonging, and productivity at work (Doran and Kinchin, 2020). Considering the current health status of the individual as an integral component of his or her overall human capital, Individuals with greater knowledge and experience, such as health professionals, are better positioned to contribute to economic growth. Weil (2007) outlines several ways in which health impacts economic growth. Additionally, the inclination of more productive workers to pursue higher education further boosts productivity. As people accumulate wealth and prepare for retirement, a growing percentage engage in investments, collectively elevating the standard for education. However, it is crucial to acknowledge three main adverse effects. Researchers in the literature employ the empirical economic model to elucidate the connection between growth and health, summarizing it through the fundamental Cobb-Douglas production function that accepts a composite input of labor and capital.

$$y_{it} = A_{it} K_{it}^{\alpha} H_{it}^{1-\alpha} \quad 1$$

In this context, 't' denotes specific time periods, 'i' represents countries, 'A' signifies the productivity term unique to each nation, 'K' represents physical capital, 'H' denotes the total stock of human capital, and 'Y' stands for output. The initial outcome arises from the overall enhanced productivity of the human capital pool, particularly among healthier workers. In the framework of the model, we make the following assumptions: 't' takes values of 1, 2, 3, and 'i' takes values of 1, 2, 3, and so forth.

$$y_{it} = c + \alpha_1 h_{it} + \gamma X_{it} + \delta_i + \mu_t + \varepsilon_{it} \quad 2$$

In the equation, 'Y' represents output, measured by real GDP or GDP per capita, where 'c' denotes an unexplained trait of the independent variable, and 'h' stands for the health variable (measured by life expectancy in years or adult survival rate, investment in health sector or health sector finance, Hospital bed per 1000 adults and domestic finance of health sector). The variables 'a1,' 'γ,' and 'δ' represent the error term of the regression findings, common country- and time-specific effects, and the control variable and health variable, respectively.

METHODOLOGY

- **Theoretical Framework**

This study's theoretical framework is based on work by Grossman (1972), who created a theoretical health production function and outlined it as follows:

$H = F(X)$ 1

Recall that X is a vector that represents each individual injection into the health building, F, and that H is a measure of the individual health result. Richness, eating patterns, the use of public goods, health-related worry, education, early personal endowments like genetic composition, and community endowments like the environment are just a few of the variables that make up the vector. For microlevel health output analysis, Grossman developed a theoretical model of the health output function. Not the micro-level analysis, but the production system analysis is the main objective here. To guarantee consistency between micro and macro analysis, we first split the vector X sections into subsector vectors that included social, environmental, and economic components. In particular;

$h = F(Y, S, V)$ 2

Where S is a vector of per-capita social factors, Vis is a vector of per-capita environmental variables, and Y is a vector of per-capita economic variables.

MODEL OF THE STUDY

The research leveraged secondary data, focusing on the empirical study period spanning from 1990 to 2022. The study sourced data from prominent databases, including the International Monetary Fund's International Financial Statistics, available across various time periods, and the Central Bank of Nigeria's Statistics Bulletin. The investigation aimed to explore the relationship between health spending and macroeconomic performance, specifically economic growth, utilising real variables. In the initial stage, the time series characteristics of the variables were assessed through augmented Dickey-Fuller (ADF) tests. The examination of the stationarity variable of the econometric model grounds this analytical approach. This process serves to determine the order in which variables need integration, the sequence of integration, and the point at which the variables will stabilize. Such an approach is crucial for avoiding issues like inconsistent or inaccurate regressions associated with non-stationary time series models.

The Augmented Dickey- Fuller (ADF) tests is specified as;

$\Delta Y_t = \alpha + \beta Y_{t-1} + \sum_{J=1} \Delta Y_{t-1} + \varepsilon_t$ 3

Where Δ is the difference operator

The variables lyr (output), lkpr (private investment), lkhr (health investment), and ldopr (degree of openness) are included in the vector Y that represents the variables used in this study.

In the event where β is negative and shows a significant deviation from zero, the series is stationer, or I (0).

White noise should be applied to the error term εt. The t statistics that are determined for the coefficient β in equation (13), is the ADF test.

The cointegration test was conducted using the Johansen co-integrating technique (Johansen 1991) and Johansen and Juselius (1990). The following formula is at your disposal:

$\Delta Y = \prod Y_{t-1} + \sum \Gamma \Delta Y_{t-1} + \mu + v_t$ 4

Where RGDP= (INVH, INF, LFE, MRT)

Δ, the difference operator, produces stationary terms; vt is a vector of error terms that are distributed separately; v = (v1t, v2t); the intercept is denoted by μ. Given that vt has zero mean, it is assumed that the model is vector white noise.

Using a vector error correction model, the effects of short-term variation and deviations from the cointegrating relationship were investigated on the variables after cointegration. Its basis is the regression equation.

$$\Delta Y_t = \mu + \sum \Gamma \Delta Y_{t-1} + \alpha EC_{t-1} + \varepsilon_t \quad 5$$

Where EC_t is the error correction term given by $\beta'' Y_t$ and β is the co-integrating vector. The coefficient vector reveals the speed of adjustment to the deviation from the long run relationship between the variables.

Autoregressive Distributed Lagged Model

The Autoregressive Distributed Lag (ARDL) method is a widely used modelling technique in econometrics that is used to analyse long-term interactions between variables. ARDL is a very helpful tool for evaluating cointegration between variables in a dynamic setting.

$$\Delta RGDP = \varphi_0 + \sum_{i=0}^{p} \varphi_1 \Delta RGDP_{t-1} + \sum_{i=0}^{p} \varphi_2 \Delta CHEXP_{t-1} + \sum_{i=0}^{p} \varphi_3 \Delta DMPHE_{t-1} + \sum_{i=0}^{p} \varphi_4 \Delta HB_{t-1} + \sum_{i=0}^{p} \varphi_5 \Delta LFE_{t-1} + \sum_{i=0}^{p} \varphi_6 \Delta IMR_{t-1} + \sum_{i=0}^{p} \varphi_7 \Delta INF_{t-1} + \sigma_1 RGDP + \sigma_2 CHEXP_{t-1} + \sigma_3 DMPHE_{t-1} + \varphi_4 \Delta HB_{t-1} + \varphi_5 \Delta LFE_{t-1} + \varphi_6 \Delta IMR_{t-1} + \varphi_6 \Delta INF_{t-1} + \mu_t \quad 3$$

The a priori expectations are:

$\eta_1 > 0$, $\eta_2 > 0$, $\eta_3 > 0$, $\eta_4 > 0$, $\eta_5 > 0$ and $\eta_6 < 0$.

THE VARIABLES;

INF = Inflation, GDP per capita (constant LCU), consumer prices (annual %), LFE = the whole life expectancy at birth (years), IMR = Infant mortality rate per 1,000 live births Hospital beds (per 1,000 persons), CHEXP = the current percentage of GDP allotted to health expenditures, and RGDP = the per capita domestic private health cost.

ANALYSIS AND RESULTS

Table 1: Descriptive Statistics

The essence of this test is to show the characteristics of the data used in terms of the means, medians, maximum values, minimum values etc.

	RGDP	CHEXP	DMPHE	HB	LFE	IMR	INF
Mean	50481.48	14.74904	3597.387	3.415882	77.24293	6.923529	2.696469
Median	52392.96	15.01578	3564.635	3.190000	77.26220	6.700000	2.642339
Maximum	62789.13	18.81583	5165.861	5.700000	78.84146	10.90000	8.002800
Minimum	33906.35	11.00167	2017.561	2.320000	74.56341	5.400000	-0.355546
Std. Dev.	7505.410	2.023241	939.0016	0.793543	1.302685	1.289834	1.518134
Skewness	-0.372589	-0.330733	-0.037643	0.999631	-0.307167	1.152656	1.118091
Kurtosis	2.213069	2.124041	1.948194	3.556252	1.802041	4.075368	6.027618
Jarque-Bera	1.663946	1.706858	1.575282	6.100823	2.567727	9.167075	20.06989
Probability	0.435190	0.425952	0.454917	0.047339	0.276965	0.010219	0.000044
Observations	34	34	34	34	34	34	34

Source: Author, 2023.

The real gross domestic product (RGDP) is computed using a median value of $52,392.96. This comes out to be around $50,481.48. With a standard deviation of $7,505.41, the RGDP data shows a large variety, ranging from a low of $33,906.35 to a high of $62,789.13. The distribution's high kurtosis (2.213069) indicates much thicker tails than in a normal distribution, and its negative skewness (-0.372589) shows a little leftward tilt. The indicator of healthcare expenditure, CHEXP/investment, has a mean of 14.75 and a median of 15.02. Notable is the 2.02 standard deviation, which indicates the degree of variability. The distribution of healthcare expenditures skews slightly left (skewness of -0.330733), with a positive kurtosis of 2.124041 and a somewhat longer tail.

The data contains a wide range of unique economic and health variables, each with a different level of volatility. Certain variables show departures from normal distributions, including asymmetry and heavier tails, based on skewness and kurtosis values.

For the majority of the variables, including illness mortality, newborn death rate, and healthy behaviour index, the Jarque-Bera tests and their corresponding probabilities show deviations from normalcy.

Given that the data raises the possibility that the variables may not have a perfectly normal distribution, it is important to use extra statistical techniques as needed.

To completely understand the unique dynamics and interactions between these aspects within the study's environment, further investigation and analysis may be required. Below is the unit root, which is a test for the stability of the data.

Table 2:	**Augmented Dickey-Fuller (ADF)**		**Philips-Perron (PP)**		
Variables	**Level**	**1st difference**	**Level**	**1st difference**	**Remark**
RGDP	0.1491	-3.0350**	0.906595	-3.0462**	1st order
CHEXP	3.1084**	-5.0541	2.6393*	-5.178177	Levels
DMPHE	-4.0896*	-6.2776	-3.5053*	-13.8406	Levels
HB	-1.49640	-4.05293*	-2.9281	-2.9297**	1st order
LFE	-3.8795*	-5.8966	-2.9943*	-9.1788	1st order
IMR	3.6084	-5.1546**	2.6293	-5.37827 *	1st order
INF	-2.49143	-4.15353*	-2.4221	-2.7237**	1st order

Source: Author's computation via EViews 10

A single asterisk (*) shows statistical significance at 1% level of significance. Two asterisks (**) indicate 5% level of significance.

The levels and initial differences of the different variables are shown in the table, which provides information on the dynamics and interactions within the dataset. The following significant components are included in the research: The following statistics are presented: Real Gross Domestic Product (RGDP), Healthcare Expenditure (CHEXP), Life Expectancy (LFE), Infant

Mortality Rate per 1000 Live Births (IMR), Disease Mortality per 100,000 Population (DMPHE), and Inflation Rate (INF). First-order differences, which show the variations between consecutive observations and are often used to spot trends or patterns in time-series data, are very instructive.

Table 3: Bounds Test

The test below is to evaluate if a long run relationship exists among the variables of the study.

F-Bounds Test			**Null Hypothesis: No levels relationship**	
Test Statistic	**Value**	**Signif.**	**I(0)**	**I(1)**
			Asymptotic: n=1000	
F-statistic	5.102995	10%	1.99	2.94
k	6	5%	2.27	3.28
		2.5%	2.55	3.61
		1%	2.88	3.99

Source: Author, 2023

Since the F-statistic exceeds the critical values at all tested significance levels, there is evidence to reject the null hypothesis of no levels relationship. This suggests the presence of a cointegrating relationship among the variables under consideration.

Table 4: Pairwise Granger Causality Tests

Sample: 1 34

Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
CHEXP does not Granger Cause RGDP	32	2.95582	0.0391
RGDP does not Granger Cause CHEXP		7.62311	0.0024
DMPHE does not Granger Cause RGDP	32	1.12214	0.3403
RGDP does not Granger Cause DMPHE		1.74347	0.1940

Source: Author, 2023.

The null hypothesis should be rejected since the p-value (0.0391) is more than the typical significance threshold of 0.05. Consequently, evidence exists that CHEXP Granger affects RGDP at a considerable level of 5%. The null hypothesis is strongly rejected at 0.0024, when the p-value is less than 0.05. This suggests that, at the 5% significant level, RGDP Granger causes CHEXP.

Table 5: The long results and the main estimate
Dependent Variable: RGDP
Method: Long Results
Sample: 1 34
Included observations: 34

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CHEXP	0.004638	0.002073	2.237024	0.0337
DMPHE	0.008545	0.030236	0.282612	0.7796
HB	-0.041271	0.018120	-2.277596	0.0309
IMR	-0.016549	0.010836	-1.527132	0.1384
LFE	0.005704	0.002913	1.957735	0.0607
INF	0.007640	0.001280	5.970650	0.0000
C	4.393894	0.239041	18.38135	0.0000
R-squared	0.960901	Mean dependent var		4.698177
Adjusted R-squared	0.956657	S.D. dependent var		0.067712
F-statistic	231.1132	Durbin-Watson stat		1.330802
Prob(F-statistic)	0.000000			

Source: Author, 2023

COEFFICIENT INTERPRETATION:

A one-unit increase in healthcare expenditures is equivalent to a 0.004638-unit increase in RGDP, according to the coefficient for healthcare expenditure (CHEXP), which stands at 0.004638. At the 5% significance level, the coefficient is statistically significant (prob. = 0.0337), indicating a positive correlation between healthcare spending and RGDP.

The number of illness-related fatalities per 100,000 people, or the disease mortality coefficient, is 0.008545. Although it does not seem to be statistically significant (prob. = 0.7796), this suggests that the disease mortality and RGDP in this model do not have a meaningful linear connection.

The Healthy Behaviour Index (HB), with a value of -0.041271, indicates that for every unit rise in the HB, there is a 0.041271 unit loss in RGDP. At the 5% significance level, the coefficient is statistically significant (prob. = 0.0309), indicating a negative association between RGDP and healthy behaviour.

Infant Mortality Rate (IMR): The RGDP and the infant mortality rate do not significantly correlate linearly in this model. The probability of the coefficient, -0.016549, being statistically significant is 0.1384%.

Life Expectancy, or LFE: The correlation between life expectancy and RGDP is positive, as shown by the coefficient of 0.005704, even if the link is not statistically significant at the 5% level (prob. = 0.0607).

The inflation rate, or INF: The coefficient, 0.007640, shows a positive correlation between the inflation rate and the RGDP and is highly statistically significant (prob. = 0.0000).

The intercept, or 4.393894, represents the estimated value of RGDP when all independent variables are zero in the C (Intercept) model.

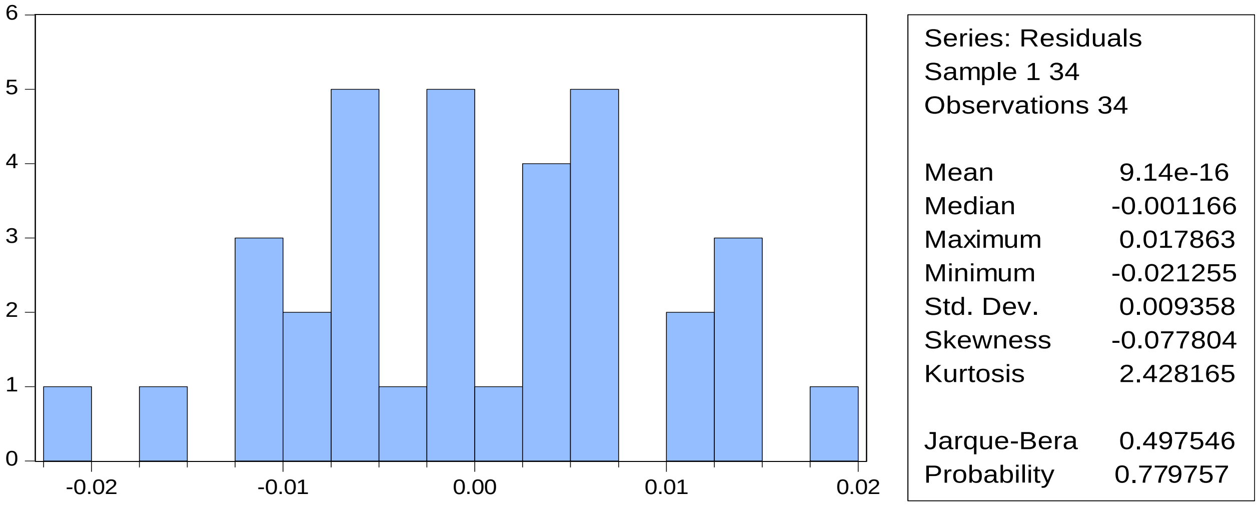
STATISTICAL MEASURES:
R-squared: The independent variables in the model explain about 96.09% of the variability in RGDP, with an R-squared of 0.960901.
R-squared modified: With 9856657, the R-squared adjusted value, the number of predictors in the model is taken into consideration.
F-statistic: Given the very low p-value (Prob (F-statistic) = 0.0000) and the F-statistic of 231.1132, the whole model seems to be statistically significant.
Durbin-Watson Measurement: The Durbin-Watson score of 1.330802, which is very close to 2, indicates that there is no detectable autocorrelation in the residuals.

Table 6: Post estimation Test
Breusch-Godfrey Serial Correlation LM Test:

F-statistic	3.049609	Prob. F(2,25)	0.1653
Obs*R-squared	6.668123	Prob. Chi-Square(2)	0.2356

Prob. F(2,25) = 0.1653 is the p-value for the F-statistic. The p-value assesses the overall importance of the lagged residuals. A small p-value, often less than 0.05, suggests evidence that denies the absence of a serial link, which is the null hypothesis.

FIGURE 1: NORMALITY TEST.
The test is to estimate the normal distribution of the model

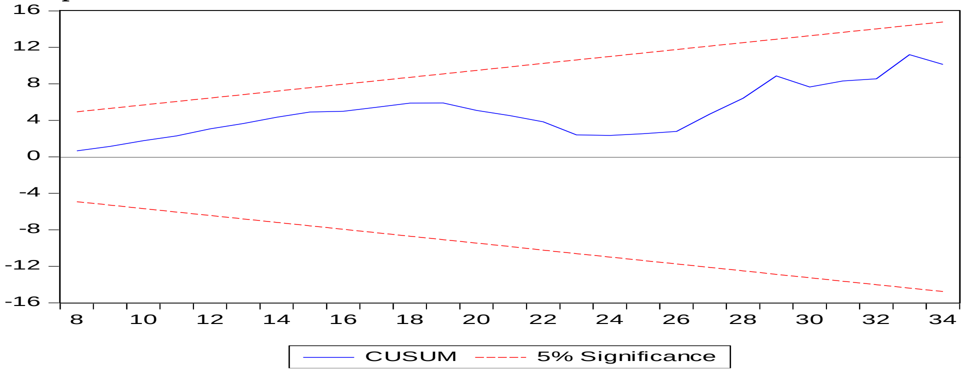


Source: Author, 2023

With a test statistic of 0.497546 and a high p-value of 0.779757, the Jarque-Bera test findings show that there is not enough evidence to rule out the hypothesis that the sample data has a normal distribution. The features that the data seem to show are consistent with a normal distribution.

Figure 2: Recursive Estimate

The posttest below estimates how stable the model is.



A recursive stability test within 5% shows that any observed changes are not statistically significant at the 5% significance level, suggesting that the relationship between the model's variables remains constant throughout time. This bolsters the notion that the model is dependable when used to forecasting.

SUMMARY AND RECOMMENDATIONS

The study's results provide strong evidence of a positive correlation between RGDP and healthcare spending. For every unit increase in healthcare spending, the RGDP increases by 0.004638, according to the CHEXP coefficient. Indicating the benefits and financial influence of healthcare spending on the nation's GDP, the previously shown connection is statistically significant (prob. = 0.0337) at the 5% level.

This allows for a thorough examination of the short- and long-term impacts of healthcare spending on RGDP using the dynamic analysis of the autoregressive distributed lag model. The research provides a thorough picture of how US health sector expenditures and macroeconomic results have changed over the course of thirty years by examining patterns over that length of time. An Investment Strategy for the Medical Sector: Policymakers need to take this into account since the health sector has shown its potential to support macroeconomic stability. Eventually, financial rewards may come from wise healthcare investments.

Further study on the financial benefits of well-thought-out healthcare programmes is warranted since it will provide crucial data for evidence-based policy.

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APPENDIX

Country Code	Time	RGDP	CHEXP	DMPHE	HB	LFE	INF	IMR
USA	1984	4.530281	11.00167	3.326372	5.7	74.56341	4.300535	10.9
USA	1990	4.594431	11.50113	3.304827	4.9	75.21463	5.397956	9.4
USA	1991	4.588157	12.54114	3.322918	4.8	75.36585	4.234964	9.1
USA	1992	4.597169	11.57232	3.491447	4.6	75.61707	3.02882	8.8
USA	1993	4.603231	12.70358	3.480337	4.5	75.41951	2.951657	8.5
USA	1994	4.615059	11.91223	3.382091	4.3	75.61951	2.607442	8.2
USA	1995	4.621391	11.2049	3.522672	4.1	75.62195	2.80542	7.9
USA	1996	4.632421	12.19833	3.494949	3.9	76.02683	2.931204	7.7
USA	1997	4.646089	13.23158	3.512693	3.8	76.42927	2.33769	7.5
USA	1998	4.660065	16.13723	3.477376	3.7	76.58049	1.552279	7.4
USA	1999	4.675417	15.11692	3.325828	3.6	76.58293	2.188027	7.2
USA	2000	4.687939	13.98694	3.401517	3.49	76.63659	3.376857	7.1
USA	2001	4.687766	13.15434	3.426114	3.47	76.83659	2.826171	7
USA	2002	4.69104	13.99167	3.463203	3.39	76.93659	1.586032	6.9
USA	2003	4.699285	14.50113	3.496876	3.33	77.03659	2.270095	6.9
USA	2004	4.711682	14.54664	3.518421	3.26	77.4878	2.677237	6.8
USA	2005	4.722549	14.57448	3.542884	3.2	77.4878	3.392747	6.7
USA	2006	4.730282	14.70358	3.560958	3.18	77.6878	3.225944	6.7
USA	2007	4.734797	14.91463	3.582713	3.14	77.9878	2.852672	6.6
USA	2008	4.731219	15.2049	3.586144	3.13	78.03902	3.8391	6.5
USA	2009	4.715971	16.19877	3.592562	3.08	78.39024	-0.35555	6.4
USA	2010	4.723976	16.19558	3.602577	3.05	78.54146	1.640043	6.2
USA	2011	4.727499	16.13764	3.612208	2.97	78.64146	3.156842	6.1
USA	2012	4.734107	16.11694	3.626579	2.93	78.74146	2.069337	6
USA	2013	4.739024	15.98694	3.628983	2.89	78.74146	1.464833	6
USA	2014	4.745663	16.19241	3.637551	2.83	78.84146	1.622223	5.9
USA	2015	4.754063	16.48109	3.65272	2.8	78.69024	0.118627	5.8
USA	2016	4.758098	16.79315	3.671017	2.77	78.53902	1.261583	5.7
USA	2017	4.76498	16.76794	3.685465	2.87	78.53902	2.13011	5.7
USA	2018	4.7753	16.64094	3.699719	2.32	78.63902	2.442583	5.6
USA	2019	4.783174	16.67647	3.713143	2.41	78.7878	1.81221	5.5
USA	2020	4.766796	18.81583	3.704069	2.32	76.98049	1.233584	5.4
USA	2021	4.791198	16.88102	3.639508	2.71	76.32927	4.697859	5.4
USA	2022	4.797884	16.88315	3.689744	2.7	78.67902	8.0028	5.9

Source: WDI, 2023. Note: The data are available in log forms and rates.