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Economic growth and health spending in India using vector error correction

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Abstract

In this paper, an investigation of health expenditure revealed that an increase in health expenditure can lead to better health opportunities, which will increase human capital, productivity, and the country's economic performance. A VECM model has been used to study the relationship between GDP and health expenditure. In this study, which is based on secondary data, GDP is the dependent variable and health investment is the independent variable. The study's data was collected in India between the years 2000 and 2020. The results show that while GDP has a significant short-term influence on health spending, there are no appreciable long-term consequences.

Keywords: Health expenditure, GDP, Investment economic growth.

INTRODUCTION:

"Sanitation generally refers to the provision of facilities and services for the safe disposal of human urine and faces," according to the World Health Organisation, while increasing sanitation puts individuals at risk for deadly illnesses and bad health, it also has a positive effect on the state of the economy. Garbage collection and wastewater disposal are two ways to preserve hygienic conditions, which contribute to better sanitation.

WHO's study on "Health and Development" addresses the connection between economic growth and health. Illnesses and sickness are barriers to developing countries' economic growth. According to Avinash Kaur (2020), investing in the health sector boosts productivity, which is crucial for economic growth. Improving sanitation in developing nations is mostly dependent on the health sector's policy and programme development, which also has a major positive impact on the nation's overall economic growth.

Economic growth depends on health spending, but there also needs to be transparency and accountability when it comes to health sector spending. The fund that was given to the ministry must be immediately monitored since economic progress will result from a proper assessment of health expenditures (Keghter et al., 2020). Economic success requires a thriving society because it shows the worth of human capital and the resiliency of a nation. A sick population diverts resources from other activities and spends less on savings and household income. Unhealthy people pay more for medical care and medications, which can hinder economic growth (Chadha et al., 2007).

The amount spent on health care in industrialised and poor nations differs significantly. The GDP is influenced by more than just health care costs. Population, income, and technological advancement are a few of the variables influencing GDP. Holly and Saksena (2011).

The financial limitations of the health system are not unique to India; public healthcare in particular is severely underfunded. These issues lead to subpar healthcare services, a significant staffing shortage, subpar infrastructure, and unmanageable out-of-pocket costs for the public healthcare delivery system (Kurian, 2015). According to Choudhury (2014), government health spending as a percentage of GDP (gross domestic product) is approximately 1% in many of India's underperforming states. (total government expenditure as a ratio of GDP).

Duran et al. (2014) found that despite the economy growing between 2007–2008 and 2012–2013, the fiscal space for health (government health expenditure as a percentage of total government expenditure) increased by just 0.2 percent. Behera and Dash (2017b) say that sustained economic growth is necessary to increase the budgetary space of Indian states in order for India to achieve UHC.

To develop, one must have good health. A healthy population grows in income, which boosts the economy of the nation. Spending on healthcare is seen as a wise investment that boosts revenue and lessens the impact of illness. Investment in healthcare is therefore crucial in developing nations like India. Prasad and Sudhakara (2016). Consequently, the question of whether economic growth affects India's health spending emerges. The study examines the relationship between health spending and India's GDP.

LITERATURE REVIEW

Li et al. (2022)- used ARDL model to study the relation between expenditure on health, CO2 emissions, and GDP in the BRICS countries. The analysis shows a long-term relationship between the variables for Brazil and China, but not a strong enough one for South Africa, where economic growth hurts health spending.

Using cointegration analysis, Bayar et al. (2021) investigated the effects of factors utilised in studies such as environment, life expectancy, and real GDP per capita on health expenditures for 27 EU nations. The findings showed that several variables had a major short-term impact on health care costs. The cointegration analysis shows that real GDP per capita and health spending are positively correlated with life expectancy.

Ndaguba et al. (2021) specifically look at South Africa's case from 1996 to 2016 to investigate the effect of public health spending on economic development. The outcome shows how PHE and HDI, the variables, are related over the long term. An increase in government spending on health care will spur economic growth through the expansion of human and physical capital.

Nicholas M. Odhiambo (2021) studied the impact of health spending and GDP using panel data analysis for 9 years. Following an analysis of the data from countries in Sub-Saharan Africa, the researcher separated health spending into the public and private domains. Countries were divided into low-income and middle-income groups to study the effects of income level.

In low-income countries, there is a causal relation between health and GDP; in middle-income countries, there is no association. In such countries, expenditure on health is positively correlated with GDP in the short term. Nonetheless, it is noted that in low-income nations, there is no correlation between health spending and economic expansion.

The link between CO2 emissions, economic growth, and health expenditure in China and India was studied by Atuahene et al. (2020). The study used a dynamic panel data model to assess how CO2 emissions and economic growth affected health spending. The results show that whereas economic development in both countries had a negative effect on health spending, CO2 levels had a discernible effect.

Avinash Kaur (2020) investigated the association between government expenditure on health, health status, and GDP in India. They observed the their is the positive impact of health spending on GDP. Policymakers should therefore focus on the health sector to improve economic performance.

Using the Bayesian VAR model, Lopreite and Zhub (2020) investigated the relationship between the ageing index, life expectancy, and economic growth in CHINA in order to better understand the impact of an ageing population on economic growth. In order to understand CHINA's dynamic pattern, the researcher also makes an analogy to the United States. The outcome shows that China's economic growth is significantly impacted by ageing in contrast to the United States. In order to raise the standard of living for China's ageing population, the paper offers policy recommendations regarding health spending.

Using a Panel co-integration test, Oche et al. (2020) investigated the association between health spending and economic performance in the member nation of the West African nations' economic community. The research findings indicated a weak and negative correlation with the number of newborn deaths, but a strong correlation with life expectancy, GDP, economic growth, and health spending.

Onofrei et al.'s (2020) analysis of Romania's health system seeks to establish a connection between health spending and the country's GDP between 1985 and 2017. The study's findings show a causal link between Romanians' GDP and health spending. It was determined that raising health spending would also enhance the effectiveness of the healthcare system and the state of the economy.

In 2020, Viju and Wullianallur Raghupathi looked into the relationship between health spending and economic performance and found that the two factors were positively correlated. Investigations were conducted into the relationship between GDP, labour productivity, and income from medical expenses. The author also made an effort to determine which health-related expenses had the biggest impact on GDP. As a result, cautious investment in different forms of healthcare can improve economic performance.

In an attempt to examine the connection between health spending and Nigeria's economic growth from 1980 to 2016, Sylvester Alor et al. (2018) employed the Generalised Method of

Moment (GMM) test. The results indicate that health spending and economic growth do not appear to be related. Furthermore, the research findings indicate that education had a favourable and considerable impact on Nigeria's economic growth during the analysed time.

Wahab and Kefeli (2016) talked about healthcare spending as a crucial component of economic improvement. Given that the government offers healthcare at reasonable costs, the author advocates for the government to have a significant role in the provision of healthcare services. It turns out that rising healthcare costs were a sign of growing human capital. Growth in human capital raises labour productivity, which in turn improves economic performance.

Mehmood et al. (2014) used the PMG approach to illustrate how health spending and high literacy rates affect economic growth for 26 different countries. The result illustrates the long-term relationships between health care expenditures, literacy rate, and per capita income. Due to the increasing demand for health services, a greater literacy rate raises health expenditures.

Chadha at al. (2007) seeks to raise knowledge regarding worker health and concentrates on enhancing worker health standards via preventive approaches. A survey was used to carry out the investigation. A significant portion of respondents agreed that companies have a social responsibility to provide preventive healthcare.

RESEARCH METHODOLOGY:

Data:

In the above study, secondary data was collected from the official website of the IMF. The time frame for which data was gathered was 2000–2020. The variables used were Health spending and the GDP of the top 19 countries of the world. (2023 data)

Objectives of the study:

To determine whether the growth of the economy has an impact on citizens' health spending by the government.

Independent and Dependent Variables

This paper uses statistical models to study the numerical correlation between the dependent variables (health) and the independent variable (GDP).

Hypotheses:

H1: Overall growth in the economy increases the growth in Health Expenditure

Analysis:

We have used the Lag selection criteria, which shows that a lag value of 4 can be used for calculation purposes. Thus, lag 4 will be used in our future research calculation. We also investigated the stationarity of the variables GDP and health spending. The null hypothesis was rejected since the probability value is less than 5%, resulting that the data is not stationary. Data was stationary at the first difference using eviews.

Cointegration was checked between the variables using the Johanson cointegration test. The null hypothesis was rejected since the Probability value is less than 5 per cent meaning that atleast one cointegrating variable is there.

Cointegrating Equation will be:

Health = .00420 – 49.68 GDP

Vector Error Correction Model

The VECM model can be applied to our investigation because the variables are cointegrated. We are unable to execute the VECM Model when the variables are not cointegrated. We are limited to applying the VECm Model even in cases when there is a long-term link between cointegrated variables.

VECM EQUATION:

D(HEALTH) = C(1)*(HEALTH(-1) - 0.0201275138903*GDP(-1) - 21.5328113006) + C(2)*D(HEALTH(-1)) + C(3)*D(HEALTH(-2)) + C(4)*D(HEALTH(-3)) + C(5)*D(HEALTH(-4)) + C(6)*D(GDP(-1)) + C(7)*D(GDP(-2)) + C(8)*D(GDP(-3)) + C(9)*D(GDP(-4)) + C(10)

To check long-run co-integration:

Hypothesis:

H_0 = There is no long-run causality from GDP to spending on Health by Government

Result: The value of c (1) is negative and but the probability value is insignificant, which means that we can accept the null hypothesis, i.e. there is no long-run co-integration between the variables. (refer to Table 2)

C (1) means Error Correction Term or speed of adjustment to achieve equilibrium position.

There is no long-run causality between the variables, the variables were tested for short-run causalitys along with the Wald test has been applied for the same.

To check short-run causality, the Wald test has been applied.

H_0 = There is no short-run causality between GDP to spending on Health by government.

Result: We can reject the null hypothesis, as there is no short-run co-integration between the variables because the probability value is significant. This means that there is short-term cointegration between the variables. (refer Table 3)

It has been observed that there is no co-integration between the variables in the long run, but in the short run, cointegration exists between variables.

Serial Correlation:

H_0= There is no serial correlation between the variables

Result: There is a serial correlation between the variables, supporting the null hypothesis, which we can reject because the Probability Chi-Square value is less than 5%. (Refer Table 4)

Heteroscedasticity:

There is no Heteroscedasticity

Result: We accept the null hypothesis since the Prob Chi-square is more than 5 percent.

There is no Heteroskedasticity. (refer Table 5)

RESULTS &DISCUSSION:

According to the analysis, the variables do not cointegrate over the long term, despite their cointegration in the short term. Various studies have discovered that a significant correlation between real GDP per capita and healthcare costs in the short run.

Given that long-run regression estimations indicate that each state's income elasticity of health expenditure relative to health expenditure is less than one, health is not a luxury good for the states of India. Historically, healthcare spending has been linked to income. Spending on healthcare is correlated with income in the short run. Over time, PHE and income actually have the opposite long-term association.

Therefore, increased economic growth is linked to improved health outcomes, which raises the immediate cost of healthcare. The low-income states and those in the southern region, where income rises as government health spending expands rapidly, and the high-income states and those in the western region, where government health spending is slowly increasing while income is rising, differ sharply from one another.

LIMITATION OF THE STUDY

This study has taken only government health expenditure into account; several other significant variables that help understand GDP growth are not included. As a result, it offers room for more research. The variables also show a serial correlation.

CONCLUSION:

The results imply that while GDP influences health spending in the short term, it has little long-term impact on health spending. Conclusion: Because of income and governmental policy, health expenditures can be impacted by GDP in the short term. However, cointegration between GDP and health expenditure does not occur since other factors—such as demand, technology, etc.—play a more significant influence over the long term.

In times of crisis, government spending on health takes precedence over GDP decline. Not even the government takes the current status of the economy into account when allocating funding. On the other hand, the government may set aside more money for the public's urgent health needs when the economy is growing. Given the need in the healthcare industry, the government can afford to allocate more short-term funding for healthcare.
Over time, a few other factors affect how health expenditures are allocated. We can conclude that there are other factors besides health that affect economic growth. These factors include education, income, gender, and other social characteristics that affect economic performance.

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Table no 1: Test of Cointegration

Date: 12/11/21 Time: 16:38
Sample (adjusted): 2005 2020
Included observations: 16 after adjustments
Trend assumption: Linear deterministic trend
Series: HEALTH GDP
Lags interval (in first differences): 1 to 4

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.662206	17.89040	15.49471	0.0214
At most 1	0.032298	0.525291	3.841465	0.4686

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.662206	17.36511	14.26460	0.0157
At most 1	0.032298	0.525291	3.841465	0.4686

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):

HEALTH	GDP
-0.262569	0.005285
1.089166	-0.038050

Unrestricted Adjustment Coefficients (alpha):

D(HEALTH)	-1.009559	0.082023
D(GDP)	-9.200050	13.94510

1 Cointegrating Equation(s): Log likelihood -108.9158

Normalized cointegrating coefficients (standard error in parentheses)

HEALTH	GDP
1.000000	-0.020128
	(0.00420)

Adjustment coefficients (standard error in parentheses)

D(HEALTH)	0.265079
	(0.09147)
D(GDP)	2.415653
	(8.34751)

Source: Authors own source

Table 2

Dependent Variable: D(HEALTH)
Method: Least Squares (Gauss-Newton / Marquardt steps)
Date: 12/11/21 Time: 16:42
Sample (adjusted): 2005 2020
Included observations: 16 after adjustments
D(HEALTH) = C(1)*(HEALTH(-1) - 0.0201275138903*GDP(-1) - 21.5328113006) + C(2)*D(HEALTH(-1)) + C(3)*D(HEALTH(-2)) + C(4) *D(HEALTH(-3)) + C(5)*D(HEALTH(-4)) + C(6)*D(GDP(-1)) + C(7) *D(GDP(-2)) + C(8)*D(GDP(-3)) + C(9)*D(GDP(-4)) + C(10)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.265079	0.091474	2.897878	0.0274
C(2)	-1.742656	0.408529	-4.265681	0.0053
C(3)	-1.550565	0.384890	-4.028597	0.0069
C(4)	-1.215537	0.388409	-3.129525	0.0203
C(5)	-0.394893	0.286805	-1.376873	0.2177
C(6)	0.019284	0.005810	3.318866	0.0160
C(7)	0.019598	0.008449	2.319488	0.0595
C(8)	0.026262	0.006417	4.092685	0.0064
C(9)	0.023706	0.010023	2.365175	0.0559
C(10)	10.88045	2.726702	3.990333	0.0072

R-squared	0.882141	Mean dependent var	3.370963
Adjusted R-squared	0.705353	S.D. dependent var	2.567204
S.E. of regression	1.393514	Akaike info criterion	3.770706
Sum squared resid	11.65129	Schwarz criterion	4.253573
Log likelihood	-20.16564	Hannan-Quinn criter.	3.795432
F-statistic	4.989819	Durbin-Watson stat	2.343825
Prob(F-statistic)	0.031838		

Table 3

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	5.869056	(4, 6)	0.0286
Chi-square	23.47622	4	0.0001

Null Hypothesis: C(6)= C(7)= C(8)= C(9)= 0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(6)	0.019284	0.005810
C(7)	0.019598	0.008449
C(8)	0.026262	0.006417
C(9)	0.023706	0.010023

Restrictions are linear in coefficients.

Table 4

Breusch-Godfrey Serial Correlation LM Test:
Null hypothesis: No serial correlation at up to 4 lags

F-statistic	1.079657	Prob. F(4,2)	0.5329
Obs*R-squared	10.93561	Prob. Chi-Square(4)	0.0273

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 12/11/21 Time: 16:44
Sample: 2005 2020
Included observations: 16
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.011704	0.098495	-0.118833	0.9163
C(2)	0.002458	0.512570	0.004796	0.9966
C(3)	0.166420	0.444493	0.374403	0.7441
C(4)	-0.051872	0.499369	-0.103875	0.9267
C(5)	0.210887	0.385004	0.547754	0.6388
C(6)	0.002926	0.007238	0.404234	0.7252
C(7)	0.005276	0.009777	0.539566	0.6435
C(8)	-0.001242	0.006604	-0.188135	0.8681
C(9)	0.000622	0.011418	0.054506	0.9615
C(10)	-1.694138	3.754759	-0.451198	0.6960
RESID(-1)	-0.123824	0.741211	-0.167057	0.8827
RESID(-2)	-1.135301	0.725089	-1.565740	0.2579
RESID(-3)	0.540376	0.833019	0.648695	0.5831
RESID(-4)	-1.413051	0.959761	-1.472294	0.2788

R-squared	0.683476	Mean dependent var	-1.25E-16
Adjusted R-squared	-1.373932	S.D. dependent var	0.881336
S.E. of regression	1.357924	Akaike info criterion	3.120350
Sum squared resid	3.687918	Schwarz criterion	3.796365
Log likelihood	-10.96280	Hannan-Quinn criter.	3.154968
F-statistic	0.332202	Durbin-Watson stat	2.106205
Prob(F-statistic)	0.915725		

Table 5

Heteroskedasticity Test: Breusch-Pagan-Godfrey
Null hypothesis: Homoskedasticity

F-statistic	0.519196	Prob. F(10,5)	0.8233
Obs*R-squared	8.150674	Prob. Chi-Square(10)	0.6141
Scaled explained SS	1.115647	Prob. Chi-Square(10)	0.9997

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 12/11/21 Time: 16:45
Sample: 2005 2020
Included observations: 16

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-2.027807	2.165386	-0.936465	0.3920
HEALTH(-1)	0.084168	0.325258	0.258772	0.8061
GDP(-1)	-0.002952	0.005647	-0.522683	0.6235
HEALTH(-2)	0.378635	0.276226	1.370745	0.2288
HEALTH(-3)	0.071429	0.231102	0.309080	0.7697
HEALTH(-4)	0.052327	0.254438	0.205658	0.8452
HEALTH(-5)	-0.043793	0.263653	-0.166099	0.8746
GDP(-2)	0.000205	0.007418	0.027630	0.9790
GDP(-3)	-0.008263	0.009066	-0.911487	0.4038
GDP(-4)	-0.001188	0.009322	-0.127465	0.9035
GDP(-5)	-0.007365	0.010001	-0.736409	0.4946

R-squared	0.509417	Mean dependent var	0.728206
Adjusted R-squared	-0.471749	S.D. dependent var	1.049347
S.E. of regression	1.273022	Akaike info criterion	3.532513
Sum squared resid	8.102920	Schwarz criterion	4.063668
Log likelihood	-17.26010	Hannan-Quinn criter.	3.559712
F-statistic	0.519196	Durbin-Watson stat	2.074288
Prob(F-statistic)	0.823312		