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PVAR Analysis of Environmental Pollution, Health Expenditure and Economic Growth: Evidence from Sub – Saharan Africa

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ABSTRACT: This study broadly examined the relationship among the environmental pollution, health expenditure and economic growth in SSA using data spanning from 1986 to 2020. The data for this study was secondary in nature and they were sourced from World Bank Development Indicator. The study employed Panel Vector Autoregressive model to capture the stated objective. The impulse response function results showed that GDP exerts significant positive impact on $C0_2$, N_20 and CH_4 in SSA but the response of the GDP to the standard deviation of $C0_2$ is more pronounced. In a similar manner, GDP also responds positively and significantly to the movement of health care expenditure but the response of GDP to the movement of TB is predominantly negative. The study, therefore, concluded based on findings that environmental pollution is still highly pronounced in SSA and its attendant effect on health has increased health expenditure in SSA as well as the numbers of doctors available in SSA are not enough despite huge expenditure on health sector. Based on the findings and conclusions of this study, it was recommended that governments of SSA should increase the budgetary allocation and financial resources of the health sector so as to sustain the flow of resources to improve the health outcomes. Moreover, government should ensure probity and accountability through closed monitoring and proper attention to health spending.

KEYWORDS: Environmental pollution, Health expenditure, Economic growth and Panel Vector Autoregressive Model

INTRODUCTION

Environmental pollution can be attributed to emission from energy production and consumption and excessive energy consumption tends to expose the environment to the danger of climatic change, pollution and unhealthy condition for man (Zhao, Niu and Zhang, 2012). In compliance with the critical relationship among these variables, many studies for instance (Hussin, Muhammad and Siti, (2016), Muhammed, Sebastian, Hafezali and Kiltisak (2019) and Fanglin-Chen *et al* (2021)) analyzed the empirical link between CO_2 emission and human health. Moreover, Anis. O., Bassem, K. and Montassar, K. (2023) also stated that contact with air pollution, among other ecological pressures; create high morbidity, disability, and mortality. It is suggested that the increasing GDP of a country potentially contributes to the enhancement of its national health and R&D expenditures because increasing economic growth is followed by prosperity and development of the nation, ultimately enhancing its national health and environmental conditions. . The current study (Chaabouni *et. al* 2017) argued that the higher the energy consumption in a country, the greater is the expenditure on health, which is due to an increase in health issues and concerns associated with environmental pollution caused by energy consumption. Moreover, growing urbanization in sub Saharan African countries brings about negative effects on health as the population lacks access to affordable and renewable energy. The combustion of biomass and the coal in urban areas leads to high levels of indoor and outdoor air pollution which leads to health challenges. In addition, global warming is modifying African life style with deep impact on their health causing extra funds implementation on health facilities as a result of high demand for energy use. The role of economic growth in determining health expenditure cannot be over-emphasized. Economic growth has the propensity to enhance the health expenditure of countries. The higher the economic growth of a country, the better is the conditions for the country, to spend on its health. Therefore, Mohammed *et.al* (2019) opined that higher economic growth of country facilitates health expenditure. In this regard, previous studies suggest a strong association between environmental pollution, health expenditure, and GDP of a country.

The per capita health expenditure has greatly increased since 2000 till date. Despite the fact that the health expenditure has risen from 2.9% in 2011 to 4.9% in 2022 relative to other regions of the world like North America (from 8.2 in 2011 to 18.3 in 2022) and East Asian and Pacific(from 4.6 in 2011 to 8.1 in 2022). Yet, the per capita expenditure on health in SSA region is still the lowest among the other regions in the world (WHO 2015).

A respiratory infection caused by air pollution from incomplete energy combustion is the main threat to the health in sub- Sahara African countries. Wang (2010) reported that 43 million people would die of respiratory infection each year if a drastic measure is not taken to address the environmental challenges. In addition, air pollution alone causes premature deaths of 7 million people world-wide each year (UNEP.2020).

This deterioration of air quality demands for increase in health expenditure to improve healthy life and to finance healthcare infrastructure and public health insurance. As much as sub-Saharan African region desires to develop economically, the recent economic development, demands for energy, and the attraction of foreign investors have posed a huge concern about environmental pollution especially carbon emissions (Bekhet *et.al* 2017). It is also confirmed by Nazeer *et.al* (2016) that industrialization, urbanization, mechanization, fertilizer, pesticides, and poor management of wastes in developing economies particularly sub-Saharan African countries have had a great deadly impact on the environment where policies and regulations are not tight and strict. In light to what is stated above, Huisingh *et. al* (2015) also revealed that the main factor responsible for climate change and global warming is the ever increasing global carbon emissions engineered by human activities for instance cutting down of trees and burning of fossil fuels. It is suggested in the literature that healthcare expenditure is an important factor in explaining the level of economic growth. However, health expenditure has received less attention in government budgets of SSA and resources are very scarce in sub- Saharan Africa. In literature, only few studies explored the relationship among environmental pollution, healthcare expenditure and economic growth. Majority of the studies in literature are mainly on nexus between environmental pollution and economic growth while there are myriads of studies detailed on relationship between healthcare expenditure and economic growth. In terms of interaction among these three variables, only few studies are available and these few studies are basically on developed countries. Moreover, most of the sub-Saharan African countries still lag behind in the area of interaction among environmental pollution, healthcare expenditure and economic growth. The studies that link environmental pollution, healthcare expenditure and economic growth is highly scanty in SSA. The findings from these few available studies conducted on the three variables are contradictory and inconclusive due to different methodological applications and omission of important variables in the studies. Based on this backdrop, this study is intending to fill the lacuna in the literature as regards the link among environmental pollution, healthcare expenditure and economic growth in SSA.

The objective of this study is to examine the interaction among environmental pollution, health expenditure and economic growth in sub Saharan African countries. The rest of the paper is organized as follows: The Section two presents the relevant empirical literature. Section three describes the theoretical framework and methodology. The section 4 discusses the results while the final section concludes.

LITERATURE REVIEW

Mwunbi and Yuan (2021) analyzed the relationship between Rwanda's environmental pollution, economic growth and energy consumption. The study applied Johansen Cointegration and vector autoregressive model as the econometric tools to estimate the long run efficient and short run coefficient respectively. The result of the Johansen Cointegration confirms energy consumption and economic growth are cointegrated. The VAR result also revealed human capital has significant negative impact on environmental pollution while GDP and energy consumption has insignificant positive effect on environmental pollution.

Rahman and Alam (2021) explored the nexus between health status and health expenditure, energy consumption and environmental pollution in SAARC-BIMSTEC region. The study utilized the panel autoregressive distributed lag (ARDL) model and heterogeneous panel causality test to examine the variables involved in the study. The result of panel ARDL model revealed that there is significant positive relationship between energy consumption health expenditure and economic growth. They also showed that there is unidirectional causal relationship between energy consumption, environmental pollution and health status.

Dinh and Shih-Mo (2015) used panel data to explore the dynamic causal association among environmental pollution, economic development, foreign direct investment (FDI) and energy use in the 12 most populated countries in Asia. This panel study reveals data that confirms the Environmental Kuznets Curve (EKC) and those CO_2 emissions continue to decrease as income rates exceed 8.9341 (in logarithms). The study also employed Granger's causality to check and consider the presence of both short-term and long-term causal links between these factors, and economic development, FDI, electricity use and CO_2 emissions in the 12 most populated Asian countries are linked to Japanese wages. The results of the study indicate that these countries have traded environmental destruction for commercial activities. In fact, these findings confirm the emissions haven theory, which suggests that the less strict environmental controls of the developing countries have drawn FDI inputs. The study revealed that FDI inflows are found to be small and do not raise environmental pollution as a panel study in these 12 Asian countries.

Drabo (2011) employed Ordinary Least Square Panel regression analysis to investigate the relationship amongst health, environmental quality and economic growth applying the Environmental Kuznets Curve (EKC) hypothesis and found that environmental degradation has negative relationship with economic growth.

Faik(2021) examined the nexus between public and private health expenditure, carbon dioxide emissions, and economic growth for 36 Asian countries for the period 1991–2017. The study employed Full Modified Ordinary Least Square(FMOLS), the system

General Method of Moments (GMM), and quantile regression analysis confirm the EKC hypothesis in Asia. Quantile regression results show that public and private health expenditures can mitigate CO_2 emissions; however, these results differ for various levels of CO_2. Findings of quantile regression show a significant impact of both public and private health expenditures in reducing CO_2 at the 50^{th} and 75^{th} quantiles but results are insignificant for the 25^{th} quantile.

Ochada and Ayadi (2020) examined the association among energy consumption, air pollution and economic growth in Nigeria from 1970-2017. The study employed VAR methods to explore the shock among the three variables. The study indicates that as the shock in the economic growth rose, contemporaneous shocks (own shocks) decreases further at an increasing inverse relationship. The shock of coal energy consumption to Gross Domestic Product (GDP) per capita showed dynamic impulse response at constant positive response within the systems of the VAR equations. Likewise, GDP per capita shocks to electricity consumption indicates a positive response both in the short run and long run in the structural VAR equations. Interactions or contemporaneous shocks of CO_2 and $N0_2$ variables as proxy for air pollution indicate both negative shocks and responses to economic growth. However, the shock of growth to trade openness indicates constant positive interactions within the system of the VAR equations.

Urhie, Odebiyi, Popoola (2017) examined the nexus among economic growth, air pollution standards enforcement and employment generation in Nigeria. In contrary to theoretical assumptions, the available data show a positive association between economic growth and unemployment in Nigeria between 2000 and 2014 (WDI, 2015). With an average annual growth rate of 7.87 per cent from 2000 to 2014, Nigeria's economic performance could be seen as a miracle of prosperity. This impressive performance has culminated in more than eight times the per capita gross domestic product (GDP) of the world ($377 in 2000 to $3184 in 2014). Notwithstanding this success, the country's unemployment rate has continued to rise. Total unemployment has steadily increased from 12.3 per cent in 2006 to 23.9 per cent in 2011. Youth unemployment has remained consistently strong at over 13% since 2000. This is a sign of non-inclusive development.

Zaidi and Saidi (2018) explored the nexus between environmental pollution, health expenditure and economic growth in sub-Saharan Africa using annual data of 1990 and 2015. The study also employed panel data as a technique to assess the relative importance of health expenditure. The result of the study revealed that economic growth has a positive impact on health expenditure.

Ibukun and Osinabi (2020) explored environmental quality, economic growth and health expenditure in 47 African countries using period between 2000 and 2018. The study used both statics (pooled OLS and fixed/random effect) and dynamic (system GMM) estimation method for the study. The result of the study showed that there is positive and significant relationship between environment quality and health expenditure. The study also exhibited that economic growth has positive impact on health expenditure in Africa.

MEHODOLOGY

3.2 Model Specification

Panel Vector Autoregressive model was used to examine the interaction among environmental pollution, healthcare expenditure and economic growth in SSA. The study adopted the work of Zaidi and Saidi (2018) with modifications. Therefore, the model for the study is as specified below:

$_{R}GDP_{it} = f(CO_{2_{it}}, N_20_{it}, CH_{4_{it}}, HEP_{it}, NOD_{it}, TB_{it}, INV_{it},)$-------------------------------3.6

Explicitly, equation 3.8 can be re-stated as below

$_{R}GDP_{it} = \phi_0 + \phi_1 CO_{2_{it}} + \phi_2 N_2 0_{it} + \phi_3 CH_{4_{it}} + \phi_4 HEP_{it} + \phi_5 NOD_{it} + TB_{it} + \varepsilon_t$----------3.7

Where

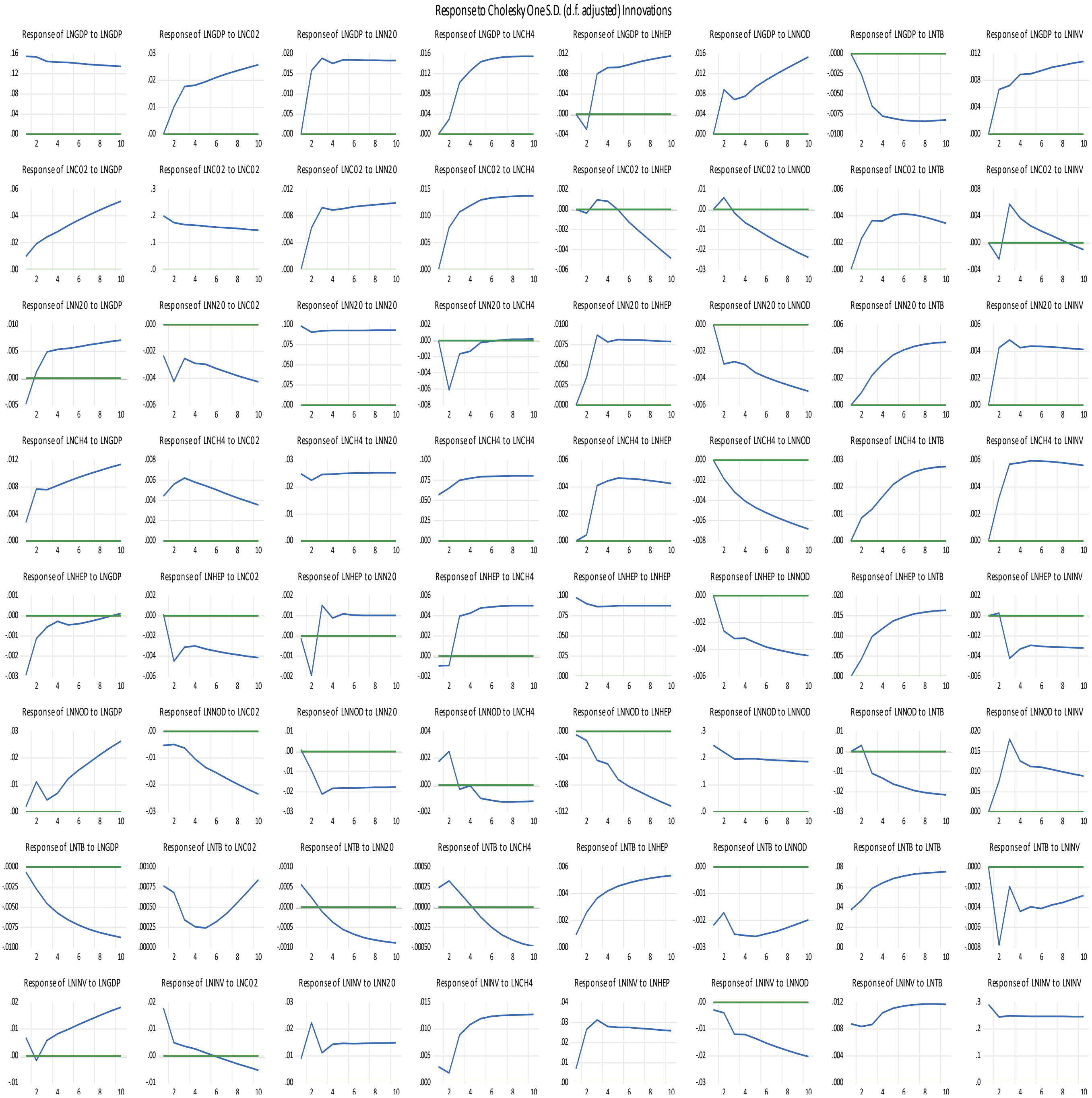
$_{R}$GDP= Real Gross Domestic Product

HEP= Health Expenditure,
NOD= Number of Doctors,
TB= Tuberculosis
ε_t= Error term

RESULTS AND DISCUSSION

4.9 Panel VAR result

4.9.1: Impulse response



The impulse response function is used to ascertain how shock to one endogenous variable impacts the current and future values of another endogenous variable. Here, we are starting with how shocks to CO2, N2O, CH4, HEP, NOD, TB, and INV impact GDP. Figure 7 presents the response of GDP to one standard deviation shock to CO2, N2O, CH4, HEP, NOD, TB and INV. The graph 2 in first row of Fig.7 showed that GDP exert significant positive response to the movement in CO2. This implies that CO2 in SSA is getting more serious as economy is growing. The graph 3 and 4 in the first row of the Fig 7 also revealed that N2O and CH4 exhibited weak positive relationship with GDP. This implies that N2O and CH4 is also increasing but not in high magnitude of CO2 as GDP is improving in SSA. The graph 6 in the first row of Fig 7 showed that number of doctors in the early period or in the short run exerts negative relationship with GDP but in the long run at period 4-10, NOD maintains positive relationship with GDP. This indicates that in the 1986 to 2002, the no of doctors are not enough but in the long run, more NOD are produced.

The graph 5 in the first row of this Fig 7 shows that GDP response is significantly positive to the movement of HEP. This implies that as economy is growing fast, there is rapid increase in health expenditure in SSA. The graph 7 in the first row of fig 7, GDP responded predominantly negative to the movement of TB. This indicates that as economy is getting better, TB as a disease is drastically reducing in the SSA economies. The graph 8 in the first row of the fig 7 also showed that GDP responded significant positive to the movement of investment in SSA. This implies that as the economies of SSA are growing, investment has tendency

to increases at the same pace. The second row of fig 7 depicts that the response of C02 to standard deviation shock to GDP. The graph shows that C02 exhibits a relative positive response to standard deviation shock to GDP. This also implies that the C02 is growing at expense of GDP in SSA. The graph on the third row of fig 7 portrayed the response of N20 to standard deviation shock to GDP. In the graph, N20 also responded positively to the standard deviation shock of GDP. The same response is CH4 to GDP in row four of the fig7. The fifth row of fig.7 shows that HEP responds positively to GDP and it is more pronounced in 10th period. In the row six, the response of NOD to GDP is negative in the second period of the graph but start to response positively from 4th period to 10th period. The graph one in row seven also depicts that the response of TB to standard deviation to the GDP is negative night from 1st period to 10th period. This implies that there is absence of TB in SSA as GDP is increasing.
In row eight of the figure seven 7, the graph one there depict the response of INV the standard deviation shock to GDP. Investment in the first period is negative and later pick up to response positively from 4th to 10th period.

4.9.2: Variance Decomposition

Variance decomposition measures the percentage of the forecast error variance in one variable accounted for by innovation in itself and other variables. The variance decomposition explains the contribution of each shock to the behaviours of real gross domestic product in SSA. The table 4.9.2a below shows that the contribution of GDP from the feedback shock is very high throughout the period, that is, from 100% in the first period to 94.5% in the 10th period. The contributions of C02, N20 and CH4 to the GDP are significant but that of the C02 is more pronounced than N20 and CH4 in SSA. HEP and NOD are the next contribution to the GDP and it is equally significant most especially in the 5th and 10th periods. The contribution of INV to the GDP is positively weak from 0% in the Ist period to 0.25% in the 6th period to about 0.36 in 10th period. The contribution from TB is highly insignificant but positive. The analysis corroborates what we obtained under impulse response result as discussed in first row of figure 7.

The contribution of C02 from the feedback shock of table 4.9.2b below is very high initially. 99.78% in the 1st period but reduced to 98.41% in the 5th period and to about 94% in the 10th period. The Contribution of C02 to the GDP is significant and positive increase from 0.23 in the Ist period to 1.87% in the 5th period to about 4.48 in the 10th period. NOD shock is the next followed by others.

The contribution of HEP from the feedback shock of table 4.9.2e below is very high initially. 99.90% in the 1st period but reduced to 97.5% in the 5th period and to about 97.24% in the 10th period. The Contribution of HEP to the GDP is significant and positive increase from 0.091 in the Ist period to 0.026% in the 5th period to about 0.013 in the 10th period. NOD shock is the next followed by others.

Table 4.92a : Variance of Decomposition of GDP

Period	SE	INGDP	INCO$_2$	INN2O	INCH$_4$	INHEP	INNOD	INTB	ININV
1	0.1546	100.00	0.000	0.00	0.000	0.000	0.000	0.000	0.000
3	0.264	97.881	0.596	0.867	0.162	0.104	0.179	0.071	0.139
6	0.365	96.122	1.182	1.190	0.523	0.254	0.288	0.182	0.259
9	0.441	94.88	1.673	1.334	0.722	0.353	0.463	0.233	0.339
10	0.463	94.51	1.829	1.367	0.767	0.383	0.525	0.242	0.363

Source; Author Computation (2024)

Table 4.92b: Variance Decomposition of CO$_2$

Period	S.E	INGDP	LNCO2	LNH20	INCH4	INHEP	INNOD	INTB	ININV
1	0.200	0.238	99.78	0.000	0.000	0.000	0.000	0.000	0.000
3	0.316	1.061	98.545	0.123	0.176	0.001	0.037	0.019	0.039
6	0.427	2.335	96.825	0.204	0.363	0.002	0.189	0.036	0.034
9	0.510	3.920	94.735	0.250	0.468	0.013	0.546	0.043	0.024
10	0.534	4.488	93.97	0.263	0.492	0.020	0.699	0.043	0.021

Source; Author Computation (2024)

Table 4.92c: Variance Decomposition of NO2

Period	S.E	INGDP	LNCO2	LNH20	INCH4	INHEP	INNOD	INTB	ININV
1	0.099	0.238	0.055	99.71	0.000	0.000	0.000	0.000	0.000
3	0.163	0.181	0.111	98.988	0.151	0.327	0.061	0.022	0.156
6	0.427	2.347	96.82	0.203	0.362	0.0012	0.189	0.037	0.034
9	0.510	3.920	94.73	0.250	0.468	0.013	0.546	0.042	0.024
10	0.297	0.364	0.136	98.35	0.048	0.607	0.158	0.147	0.193

Source; Author Computation (2024)

Table 4.92d: Variance Decomposition of CH4

Period	S.E	INGDP	LNCO2	LNH20	INCH4	INHEP	INNOD	INTB	ININV
1	0.062	0.190	0.505	16.00	83.30	0.000	0.000	0.000	0.000
3	0.123	0.821	0.595	11.44	86.64	0.113	0.089	0.014	0.284
6	0.190	0.990	0.495	9.938	87.69	0.221	0.219	0.041	0.406
9	0.241	1.178	0.402	9.463	87.90	0.240	0.328	0.062	0.425
10	0.256	1.243	0.376	9.373	87.91	0.241	0.363	0.066	0.425

Source; Author Computation (2024)

Table 4.92e: Variance Decomposition of HEP

Period	S.E	INGDP	LNCO2	LNH20	INCH4	INHEP	INNOD	INTB	ININV
1	0.097	0.091	0.000	0.000	0.010	99.90	0.000	0.000	0.000
3	0.159	0.041	0.119	0.024	0.069	99.15	0.068	0.456	0.071
6	0.220	0.022	0.128	0.019	0.169	98.10	0.111	1.357	0.095
9	0.269	0.015	0.148	0.017	0.216	97.40	0.147	1.948	0.104
10	0.283	0.013	0.155	0.017	0.226	97.24	0.158	2.087	0.107

Source; Author Computation (2024)

The study also investigated the interactions among the three important variables covered in the study which is objective number four. The Panel vector Auto-regressive model was used to achieve this objective. The results are analysed using both the impulse response functions and the variance decompositions function. The results of both functions are very similar and also in the same line with that of trend analysis and ARDL panel estimates. The results show that the environmental variables such as $C0_2$ $N0_2$ and CH_4 have positive relationship with GDP with different magnitude in SSA. Carbon dioxide emission ($C0_2$) has the highest significant impact on economic growth in SSA. Improvement in growth rate spurred the emission of Carbon dioxide in SSA. The results of VAR also revealed that the GDP response is significantly positive to the movement of HEP which indicates that as the economy is growing, the health care expenditure is increasing. This is in line with a priori expectation. It is also in consonance with the findings of Wong Sing Yin (2021), Raghupathi (2020) and Piabuo & Tieguhong (2017).
The results of the study also revealed that there is negative relationship between the numbers of doctors in the short run but exhibit positive relationship in long run-run. The findings from this study equally showed that the respond TB to standard deviation to the GDP is negative. This indicates that TB disease is a hindrance to the economic growth. This finding is in tandem with theoretical connotation.

CONCLUSION AND RECOMMENDATIONS

This study examined the relationship among environmental pollution, health expenditure and economic growth in SSA. The Panel Vector Auto-regressive model of impulse response function and variance decomposition results for this objective which assesses the interaction among the environmental pollution, health expenditure and economic growth in SSA are as follows: The impulse response function results showed that GDP exerts significant positive impact on $C0_2$, N_20 and CH_4 in SSA but the response of the GDP to the standard deviation of $C0_2$ is more pronounced. In a similar manner, GDP also responds positively and significantly to the movement of health care expenditure but the response of GDP to the movement of TB is predominantly negative. Governments of SSA should increase the budgetary allocation and financial resources to health sector so as to sustain the flows of resources to improve the health outcome. Moreover, government should double the budgetary allocation and also ensure probity and accountability through closed monitoring and proper attention to health spending.

REFERENCES

1) Mwunbi, M. & Yuan, X. (2021). Environmental Pollution Nexus, Economic growth and energy consumption; Modern Economy 12(1), 667-688.
2) Rahman, M.M & Alam, K (2021). The Nexus between Health Status and Health Expenditure Energy Consumption and Environmental Pollution in SAARC-BIMSTEC region BMC Public Health 21(1694), 1-12.
3) Yang L & Yuan S.L.(2010). The Relationship between Economic Growth and Environmental Pollution based on Time Series Data in Zhejiang province; Journal of Cambridge Studies 7(1), 3-42
4) Zaidi S & Saidi K (2018) Environmental Pollution, Health Expenditure and Economic Growth in Sun-Saharan African Countries; Sustainable Cities and Society 4(34), 1-10
5) Hussin A., Muhammad A. & Siti, K. Z.(2016). The impact of environmental quality on public health expenditure in Malaysia : Asian Pacific Journal of Advanced Business and Social Studies, 2(2),365-379.

6) Chaabouni, S., Zghidi, N., & Mbarek, M. B. (2017). “On the causal dynamics between CO2 emissions, health expenditures and economic growth.” Sustainable cities and society; 22(3),184-19.
7) Dinh H. L., & Shih-Mo L. (2015). Dynamic causal relationships among CO2 emissions, energy consumption, economic growth and FDI in the most populous Asian countries. Journal of Advance Management & Applied Economics; 5, (1), 1-5
8) Drabo, A. (2011). Interrelationship between health, environmental quality and economic activity: What consequence for economic convergence. HALCERDLetudes et Documents, E 05 Archives-Ouvertes: 1-2
9) Muhammed, H., Sebastian, K., Hafezali, I.H. & Kiltisak, J. (2019). Impact of economic growth, environmental pollution and energy consumption on health expenditure and R&D expenditure of ASEAN countries.
10) Ochada, I.A & Ayadi, F.S.(2020). Energy consumption, air pollution and economic growth in Nigeria, Journal of Economic Studies (JES); 17(1), 1-12.
11) Piabuo, S.M & guhong, J.C. (2017). Health expenditure and economic growth: Analysis between CEMAC and selected African countries:Health Economic Review; 7(23),1-13.
12) Raghupathi, V & Raghupathi, W.(2020). Health expenditure and economic performance in United States: Frontiers in Public Health Economics.
13) Urhie, E,, Odebiyi, J, & Popoola. R (2017). Economic growth, air pollution standards enforcement and employment generation nexus in the Nigerian context, Innovational Journal of Innovative Research and Development; 6(5) 1-3.
14) UNEP (2016). Regional Assessment for Africa.
15) Wang, C. M., Hsueh, H. P., Li, F., & Wu, C. F. (2020). Bootstrap ARDL on health expenditure, CO2 emissions, and GDP growth relationship for 18 OECD Countries. Frontiers in Public Healt; 7(11), 1–9.
16) WHO (2018). Air Pollution | WHO | Regional Office for Africa. https://www.afro.who.int/healthtopics/air-pollution
17) Yang, J., & Zhang, B. (2018). Air Pollution and Healthcare Expenditure: Implication for the Benefit of Air Pollution Control in China. Environment International, 120, 443–455.
18) Anis. O., Bassem, K. and Montassar, K. (2023) Impact of health expenditure and environmental degradation on health status - Disability adjust life years and infant mortality: PubMed central(PMC), 1-10.
19) Fanglin Chen et al (2021). Cost of economic growth: Air pollution and health expenditure;
20) National Library of Medicine.Fidel, E.H. (2015). The effect of environmental quality on development in Low-income countries: Application of an Environmental Quality Trajectory (EQT) with cross country data, Journal of Sustainable Development; 34(2), 1-3.